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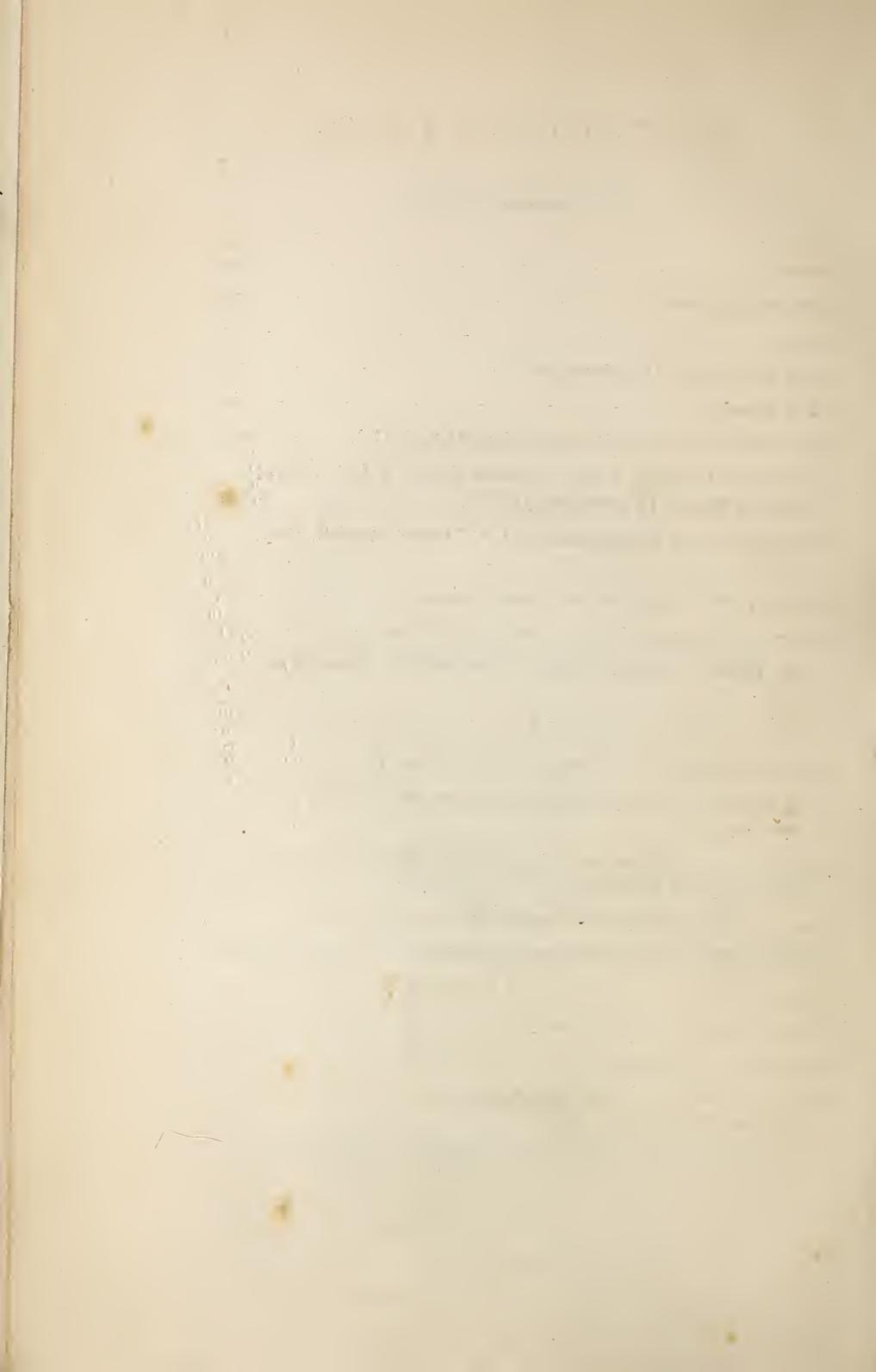
OF THE

DORSET NATURAL HISTORY AND
ANTIQUARIAN FIELD CLUB.

VOLUME VII.

Sherborne:

PRINTED AT THE "JOURNAL" OFFICES, SOUTH STREET.



C.O.N.T.E.N.T.S.

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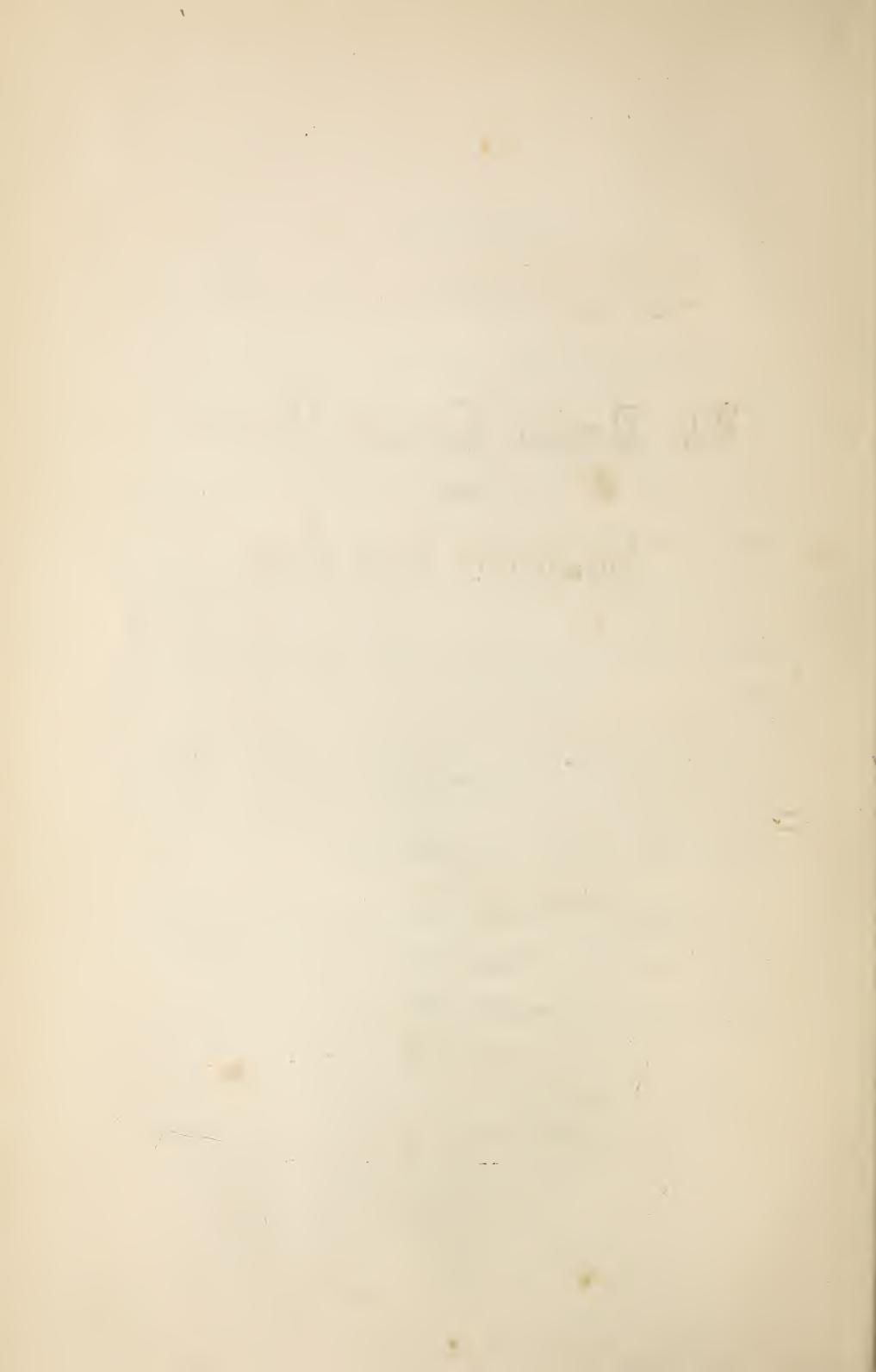
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Antiquarian Field Club.

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* * Members will oblige by informing the Secretary of any error or change in Address.





The Meetings and Transactions of the Dorset Natural History & Antiquarian Society during 1885.

By M. G. STUART, M.A., F.G.S.



HE first meeting of the year took place at the County Museum, Dorchester, on Tuesday, May 19th, when the President, Treasurer, and about 30 members were present.

The President opened the proceedings by referring to the death of Professor Buckman, F.G.S., etc., the Hon. Secretary of the Club, and the loss which the Society had suffered by his removal from the sphere of active work and interest in connection with it. In Professor Buckman he had always recognised one of the originators of the Society, and one of the most constant attendants at the meetings.

The President presented, on behalf of the author, for distribution among the members of the Club, printed copies of a short poem or "Monody on the death of Professor James Buckman" (the late secretary), by his old friend, Mr. Edwin Lees, F.L.S., F.G.S., Vice President of the Malvern and Worcestershire Naturalists' Club, and Honorary Member of this Club.

The Treasurer presented the balance-sheet for the financial year from May, 1884, and congratulated the Club on its satisfactory character. The general statement this year included the balance in hand, £30 19s., as well as the subscriptions due at the moment, the arrears, and those of the present year, 1885. This showed the assets of the Club, good and bad, to be £139 9s.

There were no debts, the greater part of the new volume of the Proceedings was completed, and he hoped to be able to place it before the Club at their next meeting. He had good reason to hope that there would be a considerable balance left towards defraying the expenses of Volume vii.

With regard to the receipts and expenditure the Treasurer said that during the past year the Club had received £133 2s. 5d., and had paid away £102 3s. 5d., leaving a cash balance of £30 19s. Of these expenses the larger portion had been paid for the publication of Volume V. of the proceedings.

During the year the Club had gained 19 new members ; on the other hand 14 were lost, 12 having resigned, and 2 having been removed by death. The total number of members at the present was 169.

The President and Treasurer were re-elected unanimously for office during the ensuing year.

The President proposed Mr. Morton Stuart as Secretary of the Society in the place of the late Professor Buckman. This was seconded by the Rev. O. P. Cambridge (Hon. Treasurer) and carried.

A proposal was introduced by the Hon. Treasurer for the appointment of a committee of members living in various parts of the county, who from time to time should co-operate with the Secretary of the Society, and, from their greater knowledge of particular localities, should assist in carrying out the necessary arrangements for holding meetings, particularly with regard to organis-

ing carriage accommodation and providing luncheon. This was agreed to after some discussion, and a Field Meeting Committee was appointed, consisting of some 30 members distributed amongst the chief centres throughout the county.

Six new members were elected.

The question of the most suitable localities for meetings of the Club during the summer months was then brought forward by the Treasurer, and, after some discussion Bindon Abbey (in connection with the Weymouth Field Club) was arranged for the June meeting, Swanage for July, Bere Regis and Bloxworth for August, and Pilsdon Hill for September.

The Treasurer mentioned that he had received a letter from the Rev. C. H. Mayo calling the attention of the Club to the importance of preserving copies of the inscriptions on monumental brasses throughout the county.

The President said that he felt this was an opportunity of calling attention to the late additions to the Dorset County Museum. During the year three very important additions had been made to the Museum, viz., The Warne Collection of Antiquities, formed by Mr. Warne, the author of various works on the Archaeology of Dorset, and especially "Ancient Dorset." The second addition to the Museum was the Ship Collection of Palaeontological character, and of especial value from the almost unique series of marsupites from the Upper Chalk. The third collection was that formed by Mr. Summers, late of Stoke Wake, which was particularly illustrative of the fossil fauna of the Kimmeridge clay. The President then selected 3 or 4 leading genera from these new collections as the subject of a short address, pointing out their character and their distribution in time and space.

From the Museum the members walked to Poundbury, where a paper was read by Mr. E. Cunnington.

On the return from Poundbury about 30 members dined

together at the King's Arms Hotel, after which the President read his address, taking as his subject "Earthquakes and Volcanoes," which will be found at the beginning of this volume.

THE SECOND MEETING of the year was held at Bindon Abbey, on the afternoon of Wednesday, June 3rd. This site having been previously fixed upon by the recently established Nat. Hist. Society of Weymouth it was consequently thought advisable to co-operate with that Society in carrying out the meeting. An interesting paper describing the history and the architectural features of the Abbey was read by Mr. H. T. Moule, of Dorchester. After leaving Bindon Abbey, Wool Manor House and the curious old Bridge, were examined. Tea was provided at the Bear Inn, at Wool, after which the party separated. The members (including members of both societies) present at this meeting were about 60.

THE THIRD MEETING of the year was held at Swanage on Wednesday, July 22nd. There were present the President, the Treasurer, the Secretary, and about 45 members and friends. Swanage was visited by the Society about eight years previously, when the chief subject for discussion was the Geological character of the district, and especially of the Purbeck series lying to the west; it was therefore thought advisable to start immediately on meeting, drive to Studland and begin the day's work from that point.

The interesting old Norman church, which has been lately restored, was described by the Rector, the Rev. Charles Digby. The curious rifts, which occur in the chancel arch, were pointed out and accounted for by the bed of clay on which the foundations rest having altered its position. It appears probable that the walls have also moved. The date of the oldest portion of the structure is considered to be 1130, and it might be considered an exceptionally fine example of the late Norman period.

From the Church at Studland the party divided, one section, under the leadership of the President and Treasurer walked to Littlesea, (distant about 2 miles), a lagoon, fed partly by the drainage of the boggy district lying on its western border, and partly by high Spring tides, which gain access through a gap in the sand dunes on its eastern margin. The walk was by no means an easy one on such a hot July morning. The route lay along the sea shore for some distance and then went sharply to the left. In so doing three separate series of sands were crossed,—*1st*, the sands of the shore. *2nd*, the Dunes, or blown sands, forming high mounds of sand constantly shifting unless bound together by the stems and creeping roots of various grasses and sedges which, fortunately, abound in these localities, such as the *Ammophila arundinacea*, *Triticum pungens* *Festuca arenaria*, etc. *3rd*, the older Bagshot sands, which constitute the formation which gives rise to the character of the district surrounding Littlesea, as it does of the great heath areas of Surrey and Hampshire. With the heath and furze of the district an associated group of sedges, waste grasses, and characteristic plants were noticed—*Carex distans*, *Carex extensa*, *Juncus maritimus*, and the following rare flowers:—*Cicendia (microcola) filiformis*, found only in five other English counties, *Pinguicula lusitanica*, restricted to four counties; *Oenanthe Pimpinelloides* *Oenanthe Lacknali*, *Samolus Valerandi*, etc. The Shore of the Lake produced a terrestrial form of *Ranunculus Baudotii*; *Scirpus parvulus* was growing in great profusion on the eastern side, where the sea finds the occasional access alluded to above. This little plant is found in only two English counties; it was restored to the British Flora by the President in 1870, since which it has been found in Cornwall. With it was associated another rare plant, *Polypogon monspeliensis*, restricted to four other counties. From this point the party proceeded to the western side of the lake in search of *Chara canescens* an aquatic plant peculiar to Cornwall and Dorset, of which only a

few decomposed fragments were found floating on the surface. During 1884 it had been found growing here in abundance, but the long continued drought and heat of the present summer appear to have destroyed it. On their return the party were fortunate enough to obtain *Marrubium vulgare* and *Chenopodium murale*. The former is generally considered to be indigenous only to the Isle of Wight, but here and elsewhere in the Isle of Purbeck it is undoubtedly indigenous, since it has been found growing in the wildest parts. The last search was for *Cynodon dactylon*, a plant found only in Devon, Cornwall, and Dorset. The lateness of the hour, however, necessitated a return to Swanage, and the President could only point out the localities of a few rare plants *en route*, such as *Cyperus longus*, *Phalaris paradoxa*, and the rare form of *Iris foetidissima*, with the yellow flower.

The Entomologists, under the leadership of the Treasurer, were no less successful, and were thoroughly satisfied with their visit to Littlesea. Among others the following rare species of Lepidoptera were obtained in the locality:—*Acidalia straminata*, *A. emutata*, *Hydrelia uncana*, and *Nephopteryx genistella*.

The Geological section of the party returned from Studland and reached Swanage about 2 p.m. for the purpose of examining one of the principal stone quarries in the vicinity of the town, the arrangements for which had been made by the Rev. Lester Lester, the Rector of Langton. This quarry, which afforded a good example of the method of working the Purbeck beds of the Swanage neighbourhood for the purpose of extracting building and paving stones, was of three levels, the upper being about 30 feet below the surface, the middle about 15 feet lower, and the lowest about 35 feet. Of these only the upper level was explored, this contained about 3 veins of stone of workable value, of which the free-stone vein was the thickest. The character of the work and the mode of operation was explained by the foreman, who spared no pains in doing all he could for

the convenience of the party. At the extreme end of the working a good example of a "fault" or "joint," as it is locally called was pointed out with a down throw of 12 feet.

The various sections arrived so late at the Hotel that time only sufficed for a very hurried repast, and various papers which had been prepared for a *post-prandial* discussion had to be deferred.

After electing 6 new members the party broke up, many leaving by the 5 p.m. train.

THE FOURTH MEETING took place on Wednesday, August 19th, at Bere Regis, where the Vicar, the Rev. J. F. Langford, had engaged to read a paper on the exceptionally fine Church of the parish. The Hon. Treasurer, the Rev. O. P. Cambridge, had very kindly offered to provide luncheon on the Rectory Lawn at Bloxworth, so it was arranged to proceed there after leaving Bere Church, taking Woodbury Hill on the way. There was a large attendance, the President, the Treasurer, the Secretary, and some 60 other members and friends being present. The Vicar's paper, which was of great interest, was read under the chestnut trees in the churchyard. It was further supported by printed schedules noting the Architectural styles of the various portions of the edifice, and the subjects of the windows. These had been thoughtfully prepared by the Vicar, and handed round before the paper was read, and proved of the greatest help. After the conclusion of Mr. Langford's paper the interior of the Church was inspected. Subsequently a discussion was instituted in the churchyard on the derivation of the word "Bere," which was generally considered to signify "a wood"; also on the origin and age of the very fine wooden roof of the Church, and the identity of the twelve half-length figures on the hammer beams. It had been stated some years ago by a late Vicar, the Rev. Carrington Ley, that the roof had been brought from Italy, by Cardinal Morton. This theory had been controverted

by the late Mr. Street, who carried out the restorations. It seems not improbable that Cardinal Morton, who was living in the diocese of Ely, and was closely connected with Bere, had ordered the roof to be constructed for him in the Eastern Counties (where such roofs are known to occur, and where workmen would have understood the art of their construction), and sent it down to Dorsetshire to be put up in the Church of Bere Regis.

Leaving the village of Bere, the party walked to Woodbury Hill, an ancient British camp and the site of a Fair, which has been held there since the 14th century. The Treasurer, the Rev. O. P. Cambridge, read a short paper on the character of the camp and its connection with the other fortified hills of the neighbourhood, and then sketched the history of the Fair. Leaving Woodbury Hill a delightful walk of a mile and a half through Bere Wood brought the party to Bloxworth Church, passing on the way the curious Bound (or boundary) oak, which measures some 27 feet in circumference, and has formed the boundary between the parishes of Bere and Bloxworth for centuries. Bloxworth Church appears to have originally consisted of a small Norman structure, of which the doorway is the only remaining portion. It was then rebuilt, probably in the 14th century, partly in the pointed and partly in the decorated style, and subsequently restored in the 17th century. Its chief feature of interest consists in an hour glass, placed on the pulpit. This dates probably to the 17th century. It was described and figured in the Proceedings of the Dorset Field Club, Vol. iii., page 34. The Rectory now offered a pleasant resting place, where the Treasurer and Mrs. Cambridge had most kindly provided luncheon under the trees in the garden. The very fine collection of Spiders, Lepidoptera, and other groups of Insects belonging to the Rev. O. P. Cambridge were examined. A butterfly new to the British fauna was exhibited—*Lycœna argiades*, Pall., one of the South European and exotic groups of “tailed blues.” This specimen was taken on Bloxworth heath on the evening before the meeting by one of Mr. Cambridge’s sons. Its

capture is of great interest, as in Kirby's "European Butterflies and Moths," where it is figured and described, it is stated to be an inhabitant of Southern and Central Europe, but not occurring in Spain or Britain. Two rather rare moths were caught, one, *Platypteryx hamula*, during the walk through Bere Wood, the other *Tinea albipunctella* on the lawn during the luncheon.

Two living examples of a rare and local snake were also exhibited (*Coronella laevis*). The meeting broke up about five p.m. after a thoroughly successful day.

Two new members were elected at the meeting.

THE FIFTH and last summer meeting was held at Pilson Pen, in the neighbourhood of Bridport, on Wednesday, September 9th. Owing to the wet weather of the preceding days, and the difficulty of reaching the rendezvous from various parts of the county the meeting was a very small one, the only officer of the Club present being the Treasurer, the Rev. O. P. Cambridge, the illness of his son preventing the presence of the President. Pilson Hill, some 940 feet in height, forms the highest point in the county of Dorset. A paper, written by the Rev. W. Barnes, who was unable to be present, was read on the character of the earthworks and the inhabitants of the district by whom they were constructed. Subsequently another paper was read on the "History of the Manor of Pillesden," which had been prepared by Mr. Tom Bond, of Tyneham. After a short discussion on these papers, the party adjourned to a barn, where a sumptuous luncheon had been provided by Mr. J. S. Udal, of Symondsbury. After luncheon Mr. Udal read an excellent paper, entitled "Charles II. in Dorset," describing the wanderings of the King in the neighbourhood of Pilson, subsequent to the battle of Worcester, whilst he was attempting to escape to France. This paper it is hoped will be included in the next volume. Mr. Udal had brought from Symondsbury his quite unique collection of Dorsetshire Tokens of the 17th

century for inspection by members, but time would not admit of their being carefully studied. These tokens were issued by tradesmen during the short interval between 1648 and 1672, and on the 16th of August of the latter year they were prohibited by Act of Parliament. The party broke up early in order to catch various trains. This meeting brought the summer work of the society to a close. One new member was elected at the Pilsdon meeting.

A SIXTH (WINTER) MEETING was held on Wednesday, January 20th, 1886, at the County Museum, Dorchester, for the purpose of reading and discussing various papers remaining over from the work of the summer. The weather was snowy and unfavourable; a fairgathering, however, of some 25 members was present, when business began about 12.30 p.m. Owing to the unavoidable absence of the President the chair was taken by the Treasurer, the Rev. O. P. Cambridge.

Two new members were elected at this meeting.

The following was the list of subjects :—

1. Memoir of the late Professor Buckman, F.G.S., &c., by the President.
2. The Quaternary Tufaceous Deposit at Blashenwell, in the Isle of Purbeck, by the President.
3. Preface to the History of the Birds of Dorset, by the President.
4. On some New and Rare British Spiders, by the Treasurer.
5. Notes on *Lycaena argiades*, Pall. (a butterfly new to Britain, caught at Bloxworth, August 18th, 1885), by the Treasurer.
6. Notes on *Coronella laevis*, Boie (smooth or lizard snake), by the Treasurer.
7. The Punfield Beds of Punfield Cove, Swanage, by the Secretary.

8. Notes on the Ergot, *Claviceps purpurea*, by the Secretary.

The members adjourned to luncheon at 2 p.m. at the King's Arms, after which the work on the programme for the day was resumed, being scarcely completed by 5 o'clock, when the departure of various trains necessitated the breaking up of a thoroughly successful meeting.

This brought the work of the year to a close. It will be seen that six meetings were held during the twelve months, and that, besides various investigations during excursions in the Field, some eighteen papers were read before the Society.



176 List of New Members Elected in 1885.

AT THE DORCHESTER MEETING, MAY 21ST.

Baskett, Rev. C. R...	Morecombe Hall, Charmouth.
Disney, Mr. A. N.	.. The College, Weymouth.
Falkner, Mr. C. G...	The College, Weymouth.
Hansford, Mr. Charles	.. Dorchester.
Harrison, Mr. George	National and Provincial Bank, Wareham.
Ludlow, Rev. E.	.. Martin's Town Rectory, Dorchester.

SWANAGE MEETING, JULY 22.

Aldridge, Mr. Reginald	Poole.
Aldridge, Mrs. Reginald	Poole.
Crespi, Dr., M.D.	.. Wimborne.
Farrer, Mr. Oliver	.. Binegar Hall, Wareham.
Pinder, Mr. Reginald	Hernhurst, Bournemouth.
Urmson, Mr. F. B.	.. Hook, near Beaminster.

BERE REGIS MEETING, AUGUST 19TH.

Brown, Rev. W. C..	Tyneham Rectory, Wareham.
Sydenham, Mr. David	.. Bournemouth.

PILSDON MEETING, SEPTEMBER 9TH.

Embleton, Mr. D. E.,	
M.R.C.S.	.. St. Wilfrids, St. Michael's-road, Bournemouth.

DORCHESTER MEETING, JANUARY 20TH, 1886.

Rodd, Mr. E. S.	.. Chardstock House.
Stuart, Col. James..	The Manor House, St. Mary's, Blandford.



In Memoriam

PROFESSOR JAMES BUCKMAN, F.G.S., F.L.S., F.S.A.

PROFESSOR BUCKMAN, who was somewhat unexpectedly and suddenly removed from us the year before last, was born at Cheltenham in 1814. His father was of some influence and position at Alpeck, Worcestershire. He was twice married, first to a daughter of the Rev. W. Dunn, who died within three years of her marriage, and afterwards to a daughter of Mr. Savory, the eminent London chemist, whom he survived, and had by her two sons and three daughters, all of whom are now living.

PROFESSOR BUCKMAN was educated at a private school, on leaving which he went to London with the intention of studying medicine, but changing his mind, he returned to Cheltenham, and was shortly afterwards appointed Honorary Secretary and Lecturer to the Literary and Philosophical Institute of that town, which he held until the year 1846. At this early period of his life, he acquired a taste for science, and found time during his short residence in London to publish a list of plants found chiefly in Battersea fields. In 1846 he accepted the curatorship of a similar but more influential Institution at Birmingham. On leaving Cheltenham to enter upon the duties of this new appointment a handsome testimonial was presented to him by many personal friends and members of the Institute, "as a testimony of the sense entertained by them of his services, and a mark of

respect for his talents and private worth." He had now acquired some experience as a geologist, and was frequently summoned as a witness upon Parliamentary enquiries in connection with railway schemes. About this time he became associated with his friend Mr. Edwin Lees in a geological examination of the Malvern hills, whose lofty palæozoic mass towers over the surrounding lowlands, which are designated by Sir Roderick Murchison, the straits of Malvern, reaching as far as Shropshire and Cheshire, and were at one period covered by the sea, separating England from Wales. After holding his Birmingham appointment a couple of years, he was invited to become a candidate for a Professorship of the Cirencester Agricultural College, then just coming into existence, but he withdrew in favour of a friend. A few months later he accepted the offer of its professorial chair of Geology and Botany, which he filled until the year 1863, when he and three other Professors resigned through difficulties with the newly appointed Principal. Public sympathy was shewn them by an invitation to a banquet at Cirencester, when Professor Buckman was presented with two splendid testimonials, one from the townspeople and his scientific friends, the other from his old pupils. During his connection with the College he formed a museum of Roman antiquities in the town, obtained from the neighbouring *Corinium*, and gave to the College the fine collection of fossils he had collected from the neighbourhood of Cirencester. He also arranged and classified for Lord Eldon his museum at the Chadworth Roman villa. In 1862, he was selected to be one of the jurymen of the Great Exhibition of that year. On leaving Cirencester he came to Bradford Abbas, where he took a large farm, which he conducted on model principles. He devoted much of his leisure time to literary work, and especially to the geology of the neighbourhood, which was of especial interest to him on account of its being on the same horizon as that of the Cotteswold hills, on which he had

worked so many previous years. By a patient correlation of the two districts he identified their parallelism and placed the well developed sand-beds of Yeovil and the neighbourhood higher up in the series than is generally recognized by most geologists, who consider them to be the basement beds of the Inferior Oolite, or the uppermost zone of the Lias. They certainly appear to be a passage series, as many of the species of the upper Lias continued to live on through these sands into the shelly (Cephalopoda) bed above. The highly fossiliferous beds of Bradford Abbas enabled the Professor to make a large and varied collection of Ammonites, Belemnites, Brachiopods and other Conchifers, several of which were new. He was aided by his son, Mr. S. S. Buckman, whose successful labours are recognised by the late Mr. Davidson, in the volume of the Palaeontographical Society for 1884, where several new species of Brachiopods found by him are figured and described.

In 1876 PROFESSOR BUCKMAN founded the Dorset Natural History and Antiquarian Field Club, upon similar lines to those of the Cotteswold Club, of which he had been an eminent member and officer; he was elected Secretary at the first meeting, which arduous post, including the editorial work in connection with the Club, he filled with great ability and energy to the day of his death.

PROFESSOR BUCKMAN was author of several works, including "Our Triangle," "Letters on the Geology, Botany, and Archaeology of the neighbourhood of Cheltenham," A new and revised edition of "Murchison's Geology of the Neighbourhood of Cheltenham," "The Ancient Straits of Malvern, or an account of the marine conditions which separated England from Wales," "The Geology of the Cotteswold," "Illustrations of the Remains of Roman Art in Cirencester," "The Site of Ancient Corinium," "History of British Grasses."

He was a constant contributor to agricultural and scientific serials. The following are the names of papers read by him before the members of the Geological Society, and published in

their Quarterly Journal :—

Vol. xiv. On the Oolite Rocks of Gloucestershire and North Wales.
,, xvi. On Some Reptilian Eggs from the Great Oolite.
,, xxix. On the Cephalopoda Beds and Oolitic Sands of Dorset and Part of Somerset.
,, xxxiii. On the Cephalopoda Beds of Gloucester, Dorset, and Somerset.
,, xxxv. On the So-called Midford Sands.
,, xxxvii. On the Terminations of some Ammonites from the Inferior Oolite of Dorset and Somerset.

He gave ten Lectures at South Kensington on Farm Seeds in January, 1884 which he described to a friend "as having been hard work, especially as he was very poorly at the time." He was then probably entering upon the early stages of his malady, which terminated fatally eleven months afterwards. He died on the 22nd of November at Bradford Abbas, surrounded by his five children and soothed by their tender affection, lamented by a large circle of friends, many of whom were united to him by the bonds of fellowship as members of the Dorset Field Club, who desire, by means of the pages of this year's volume, to preserve a permanent reminiscence of their indefatigable, genial, and ever-lamented Secretary.

J. C. MANSEL-PLEYDELL,

President.





Volcanos and Earthquakes.

By J. C. MANSEL-PLEYDELL, Esq., F.L.S., F.G.S.



T is only within the last few years the phenomena of volcanos and earthquakes have been subjected to strict scientific investigation: they stand in intimate relation the one to the other exercising their energies usually over the same areas. These are sometimes of such magnitude as to upheave entire continents, and mountain masses; thermal springs, sulphureous vapours, and eruptions of mud are also their offspring. A very early belief prevailed that a central fire exists beneath the earth's crust, which belief was supposed to be supported by observations made in mines; it will be seen farther on the increase of temperature in deep mines may be accounted for under a different theory; there are however other hypotheses which are favored by eminent physicists; one, supported by Sir William Thomson, that the earth is not only rigid but solid from the surface to the centre, having cooled as a solid mass; another by the Rev. Osmond Fisher*, a Dorsetshire man born and bred, that

* Physics of the Earth's Crust, 1881.

there is a fluid or plastic interstratum, between the cooled crust and the rigid solid interior. Assuming that the earth was once fluid, Mr. Fisher considers that when the temperature cooled to the point where hydrogen and oxygen were enabled to combine, it would hold in solution the soluble substances, and, as cooling proceeded, a crust would be formed down to a certain depth, and underneath it a hot layer of original water-dissolved silicates, ever in readiness to furnish the steam, gases, and ejectamenta of the volcano. Elevation and depression alternately over the same areas (a fact well-known to geologists) strengthens the fluid-interstratum theory rather than that of the solid sphere. The presence of chlorides and hydrochlorides in some of the volcanic rocks which have been examined makes it probable that salt-water as well as fresh-water contribute towards volcanic eruptions. Diatomaceæ and other vegetable remains have been found in the mud and water ejected by an eruption; fish, which inhabit underground caverns have also been found under similar circumstances. Ehrenberg found freshwater infusorial remains in some of the Rhenish volcanic rocks. From the above facts it may be inferred that the water which supplies the steam-power of volcanos is derived from other sources than that which belong to the plastic interstratum. There are immeasurable masses of underground water available; an Artesian well sunk through a thick mass of volcanic rock near Naples sent up no less than 440 gallons a minute; the liberation of this water by the shattering effects of volcanic action upon the strata beneath, or even by capillary attraction, would allow its ingress upon the molten mass, which passing into steam, would possess an expansive power of 1700 times its volume. The levels of these underground reservoirs are continually alternating from high to low and from low to high, and when reaching a point below sea-level the salt-water will force its way through the channels which at ordinary times serve as a passage of the freshwater into the sea. An exhaustion of the freshwater supply will ensue if the eruption is of long continuance, and if its

occurrence happens to be in the vicinity of the sea, which is often the case, its energies will be maintained by an inexhaustive supply of fuel.

Professor Prestwich* considers the primary cause of volcanic eruptions may be accounted for by a contraction of the earth's crust, the result of which its secular cooling down, and the consequent pressure upon the viscous layer. Cordier estimates that a radial contraction of 0.0397th of an inch would be sufficient to supply matter to 500 of the greatest known volcanic eruptions.

The increase of temperature is estimated to be 1 Fahr. for every 50 or 55 feet descent; but it is difficult to arrive at the problem of temperature at great depths with mathematical exactness, as the lamps of the miners and the explosions of gunpowder have some disturbing force; there is a difficulty also in estimating the temperature from water issuing from Artesian wells, because convection currents mingling with the water coming down from above will sink, and tend to lower, the temperature; for this reason a deep boring near Berlin of 4172 feet which almost entirely passed through an homogeneous mass of rock-salt could not be relied upon as a test. The high temperature of thermal springs may be accounted for under the supposition that surface-water passing through rocks in a synclinal trough of great depth, and resting upon an impervious bed, would on reascending bring with it the temperature of the deepest-seated rocks with which it had come into contact.

Steam has been generally accepted as one of the main agents producing earthquakes and volcanos, when the surface-water finding its way through a porous rock or fissure, and coming into contact with highly heated rocks, would be generated into steam, and the wave propagated by its expansive force would, unless it found a vent, occasion an earthquake. An earthquake might be defined as a vibratory motion communicated to the solid materials of the earth, much in the same way as sound passes through the

* Geology, Chemical, Physical and Stratigraphical. Vol. i., p. 216.

atmosphere by vibration. Its progression usually takes a linear direction with a velocity of from twenty to thirty geographical miles a minute; sometimes it will radiate from a centre as shewn in the earthquake of Calabria in 1785, when all the towns and villages within a radius of twenty miles were overthrown. Van Humboldt has described the impression an earthquake for the first time produces upon the observer. "From early childhood," he says, "we are accustomed to contrast the mobile element of water with the immobility of the soil on which we stand, all the evidence of our senses have tended to confirm our belief in this contrast, but when suddenly the soil begins to heave, the sense of some mysterious, natural force acting upon and moving the solid globe seizes upon the mind, and in a moment the illusions of the whole of our earlier life are annihilated."

The initial force communicated to the rock masses beneath will at first squeeze together its adjacent molecules, and afterwards pull them apart, first by pressure, and then by the elasticity of the earth's crust; the wave will then pass on to the next set of molecules with similar results, and thus from molecule to molecule to enormous distances; each molecule perhaps moving only an inch or two, while the undulations will extend hundreds of miles.

If the earth was an homogeneous mass the force would produce a series of continuous waves; but as it differs in structure and consistency of material, from the solid granite to the disintegrated gravel and pliant clay, the force would experience every variety of resistive and obstructive force.

The duration of earthquakes is usually very short in comparison to their devastating power. Carracas in South America was destroyed by three shocks, which lasted three seconds; the great earthquake at Lisbon lasted about five minutes, but the first shock, which was the worst, lasted only from five to six seconds. No description of rock seems to be exempt, granite, gneiss, mica-schist are affected equally with the Secondary and Tertiary rocks, a proof that the causes lie deeper than the limit

to which these rocks extend ; at the same time there is no doubt the nature of the rocks very much affects the propagation of the shock. Earthquakes have been observed to be more destructive on rocks of loose consistence than those of more solid material. The soil has a remarkable influence on the intensity of the shock : during the Caracas earthquake, the south part of the town which was built upon a deep deposit, overlying the solid rocks beneath, escaped ; whereas the northern part which was upon a shallow deposit was entirely destroyed.

When the site of the disturbance is covered by sea a water-wave is generated, which does not roll in upon the shore until after the shock has been felt on the land ; this is caused by the momentary elevation of the beach, and after the recession of the wave it comes in with destructive power, the more so if the coast is shallow and the depth of the sea less than the height of the wave. During the great Lisbon earthquake in 1775 the wave rose 60 feet in height, causing the greatest destruction to Cadiz, and the coast of the Mediterranean.

A violent shock will produce an air-wave. In a paper by General Strachey, read before the Royal Society, he stated that a shock of sufficient violence will occasion an atmospheric wave advancing from its centre in a circular form round the globe, expanding at first until it gets half round the earth, and then contracting till it arrives at the antipodes, from which it will be thrown back, and so pass backwards and forwards until obliterated. The air-wave, being similar to a solitary wave produced in liquid, does not differ much in velocity from that of sound. A vessel at the north of Borneo heard explosions in 1883 at a distance of 1,200 miles from Krakatoa, which was then undergoing great seismic convulsions. The sounds of explosions were also heard at Ceylon on the same day, a distance of about 2,000 miles. After taking thirteen stations from which records had been received, and their distances measured in great circles from Krakatoa (the extremes being Toronto and St. Petersburg), General Strachey arrived at the conclusion that the velocity of the waves

will be 674 miles per hour, from east to west, and 706 miles for those passing from west to east. The velocity of sound for a temperature of 50 Fahr. is 757 miles an hour, and of 80 Fahr. 781 miles. With a temperature at zero the velocity will only be reduced to 723 miles an hour, which is still considerably in excess of the velocity of an air-wave travelling in the same direction as the earth's motion of revolution, that is from west to east.

The linear arrangement of volcanic vents is best illustrated in the great region of the Andes. The principal line is from latitude 43. 28. S. to 30. S., succeeded by a region of 8 degrees, in which no disturbances have been observed ; then come the volcanos of Bolivia and Peru, reaching six degrees from south to north, where another space of fourteen degrees free from volcanic action intervenes. At Quito 100 miles south of the Equator, a volcanic district again commences, which reaches 130 miles north ; and after an interval of more than six degrees come the volcanos of Guatemala in Central America, north of the Isthmus of Panama, where the great crest of the Andes becomes considerably depressed.

There is another volcanic region, extending from the Aleutian Islands in Russian America to the Moluccas, Java and Sumatra, which after taking a westerly direction of about 200 miles, turns southwards in an unbroken line of between sixty and seventy degrees of latitude.

The last to be mentioned will be the region passing through Central Asia to the Azores, commencing at China and Tartary, through Lake Aral, and the Caspian Sea to the Caucasus, the countries bordering the Black Sea, through part of Asia Minor to Syria, Greece, Naples, Sicily and Portugal. Between this long series there are breaks of considerable extent. Southern Italy presents two volcanic districts, one in the neighbourhood of Mola di Gaeta, which Pius IX chose for his temporary residence, after escaping from Rome in the revolution of 1848, disguised as one of the Bavarian ambassador's livery servants, when his

prime minister Rossi was assassinated. It extends from the Ponza Islands, several of which are entirely volcanic, to Mount Vultur in Apulia, a lofty conical hill, with a crater half-way from its summit; the other comprises the Neapolitan district, this has a north-easterly and south-westerly direction, extending from Vesuvius through the Phlegræan fields to Ischia, which has been often the scene of fearful convulsions; the early Greek colonists were more than once obliged to abandon the island. Ischia was tranquil from the date of the great eruption which occurred about the fourth century before our era, until 1301. In that year a convulsion took place which lasted two months; it was not again disturbed until 1883 when the island became once more the scene of fearful desolation, which must be still fresh in our memory. For some time before the Christian era it seems to have been the vent or safety-valve of the district, Vesuvius being dormant during that period; Plutarch speaks of the interior of its crater in his time, as being clothed with vegetation. In the year 63 A.D., this state of things was changed; an earthquake occurred which destroyed Pompeii and Herculaneum; but scarcely had their principal buildings been rebuilt, when they again fell beneath a devastating eruption in 79, in which Pliny the elder lost his life, the details of which are given in a letter of his nephew the younger Pliny, to the emperor Trajan. He had been appointed admiral by Vespasian, and happened at that time to be stationed with the fleet at Misenum. In the hopes of rendering assistance, he ordered the ships to be launched, and proceeded to the point of danger; hot stones of pumice-stone fell thickly upon the vessels, which were in danger of running aground by a sudden retreat of the sea; after landing at Stabiæ, and finding that the house to which he had repaired was in great peril from frequent and violent shocks, he and his companions betook themselves to the open fields; with danger still around them they repaired to the ships with the intention of embarking, but finding the sea too tempestuous, they were obliged to remain on

shore ; here Pliny was soon overcome by sulphurous vapours, which finally suffocated him. His body was found, uninjured and unscorched, apparently in the repose of sleep.

In 1558 after a long pause of volcanic action, a new mountain, 440 feet above the level of the sea, and about a mile and a half in circumference was formed at Baiæ, near Naples in the course of one night; several shocks of earthquake having occurred during the previous twenty-four hours. The mountain did not appear to have been raised by an eruption, but by the ground having been forced up like a bubble, which on bursting caused the present crater. The whole coast to Pozzuoli was raised many feet above the bed of the Mediterranean, and retained the greater part of that elevation for nearly a century after.

In 1775 Lisbon experienced one of the greatest and most destructive earthquakes on record. A sound of subterranean thunder was almost immediately succeeded by a violent shock, which demolished the greater part of the city, and in the space of a few minutes 60,000 persons perished. A superficial area of more than four times the size of Europe, or nearly one-twelfth of that of the globe was shaken by this earthquake, which had for its axis a line extending from Mogadore in Morocco, along the coast of Portugal to Cork, from Madeira to Finland, and from Scotland to Sardinia. The agitation of the waves extended as far as the West India Islands, and an unusual movement was observed on the surface of some of the North American Lakes.

I now turn to instances of volcanic action which have occurred in our own time, some of which are now fresh in our memory ; for instance the great eruption and earthquake which took place in the Sonda Straits in 1883, and which devastated the Island of Krakatoa, also the earthquake at Colchester, and in the south-west of England, and the Spanish earthquakes of last year.

A few words may be useful upon the volcanic dust usually accompanying eruptions, which, as is well known, contributed

largely to the destruction of Pompeii. During an eruption immense torrents of pumice-stone and ashes are driven upwards to great heights, and afterwards settle down again, the larger fragments which happen to fall upon the sea float, until the air-chambers which give them buoyancy are decomposed by the breaking up of the thin glassy partitions, when they sink. Soon after the eruption of Krakatoa, which is midway in the channel of the Sunda Straits, between Java and Sumatra, a steamer sailing up the west coast of Australia, two hundred miles from the Straits of Sunda fell in with small patches of floating pumice ; as it neared the island, these patches became more numerous and larger in size. Another vessel about 1900 miles south-south-east of the Sunda Straits, was visited by a shower of volcanic dust on August 30th. If the dust was associated with the eruption of Krakatoa of August 27th and 28th, it must have travelled 1,050 miles in three days. Two months previous to the destruction of the island a dome-shaped mass of vapour, mixed with smoke of a dark colour, was seen to rise from the lower part of the island ; from the base of the column issued dark red streaks of fire, followed by explosions, resembling reports of heavy artillery, so that the crew of a ship passing by at the time was startled, and the heat of it was felt at a distance of two miles. An apparently illimitable cloud of drifting pumice was met with by another vessel 30 miles from the island, which was so thick that a bucket let down into the sea was filled before it reached the surface of the water. A volume of vapour was shot out from the volcano in a vertical direction, with so much force that it mounted up several thousand feet ; great pieces of pumice were suspended as it were by the fiery breeze ascending upwards. In addition to the vapours, smoke, and pumice-dust, issuing from the vent, there were sulphur-troughs, out of which mud boiled up in enormous bubbles, which burst at intervals. When darkness intervened the lower part of the column of smoke was one mass of glowing red, from which tongues of yellow flame incessantly darted. The activity of the eruption continued

through June and July; then came the outburst of August 26; at 6 p.m. on that day a great sea-wave dashed with terrific force upon the coasts of Java and Sumatra; it passed down the Sunda Straits at a height of from forty to a hundred feet, and extended as far as the western and eastern shores of America, which it reached on the 27th and 29th respectively. The sea-wave produced by this eruption was also propagated to the Mauritius at the rate of 480 miles an hour, to Port Elizabeth near the Cape of Good Hope 430 miles, and to Galle 420 miles; between Galle and Aden 378 miles, the length of this great wave varied from 287 to 630 miles an hour. In Lampong Bay, notwithstanding its protection by neighbouring islands, the momentum of the sea-wave was so great that a steamer was carried three miles inland. It is terrible to think of the devastation it occasioned upon an area of more than 10,000 square miles, and accompanied with much loss of life. Great ruin was caused by the inundations along the whole extent of the north coast of Java right away to Batavia. The earth-wave does not appear to have been of any great magnitude, the force probably finding a vent near its origin. The northern part of the island has entirely disappeared, the peak which was far inland now forms a perpendicular sea-cliff, about 2,500 feet high; where land was before there is now an unfathomable abyss. The size of Krakatoa was formerly about thirty-five square miles, of which twenty-four have subsided, and only eleven remain. The neighbouring islands of Verlaten and Long Island are larger than they were before the eruption, through the ejected substances which have settled on and around the island. We have seen that some of the finer particles fell into the sea at great distances, but the finest of all, mixing with vapour, remained floating in the air-currents, and being propelled by the wind, were conveyed round the world; the condensed vapour freezing as it passed through these cold currents would cause the dark red glows observed in so many places last year in the two hemispheres; while the ash-

particles obscuring the sunlight would give blue and green tints at its rising and setting. Ashes of the same component parts as those of Krakatoa were found in snow which fell in Spain, and in rain which fell in the Netherlands, and according to the measurements taken on board of a German man-of-war, which left Anjer on the morning of the eruption, the particles reached a height of at least 3,500 feet.

Mr. Whymper gives an interesting account of an eruption in the same year (1883), which he witnessed during an ascent he was making of Chimborozo, about 45 miles south of the equator and about 19,000 feet above the sea level. On reaching a height of 16,000 feet he observed the commencement of an eruption issuing from the great cone of Cotopaxi; a column of smoke of inky blackness began to ascend from the crater, and in less than a minute the smoke had risen a perpendicular height of about 20,000 feet; at that elevation it encountered a powerful wind, and was rapidly borne towards the Pacific; it was then caught by a wind from the north, and spread rapidly in all directions. In time the volcanic-ash began to intervene between him and the sun, which assumed a green hue, changing to the colour of tarnished copper; the ash then began to fall, having travelled about 85 miles in little more than six hours, causing the summit of Chimborozo to resemble a ploughed field. The ash was extremely fine, filling the eyes and nostrils, and penetrating even into the working parts of the instruments and closed boxes. The grosser particles settled down in the valley, which was 7,000 feet below; while the finer ones still floated in the air, like a thick fog; during the time the ash was passing between him and the sun the sky varied very much in tint and tone, and had obviously connection with its varying densities.

The island of Ischia, which was the scene of a terrible earthquake in August, 1883, is composed for the most part of a rock of finely comminuted pumice, and consolidated into a homogeneous mass of pumiceous tuff, with evidences of successive volcanic operations. In the year 1302 a tremendous conflagration broke

out of the crater of the Capo d'Arso, which desolated much of the island. There was little or no indication of volcanic action except by the hot springs so common throughout the island until the year 1828, when all the houses of the town of Casamicciola were destroyed, although the shock only lasted a few seconds. After an interval of fifty-three years, in March, 1881 Casamicciola was again visited by an earthquake-shock, which, although continuing only a few seconds, reduced the town to a state of ruin. The street pavements disappeared entirely, and the ground was rent with deep fissures several inches wide. Casamicciola seems to be situated at the point where two geological fractures of this Ischian volcanic district intersect each other. Each of these three earthquakes proceeded from the point of intersection of the two lines which run from north to south, and from east to west.

Although England has never been entirely exempt from earthquake-shocks more or less, none can be compared to the one of April 22nd of last year, either in force or magnitude. On March 17th, 1871, a rather sharp shock was felt across England, another occurred on January, 1878, which shook London and several parts of England, and was felt distinctly at Lyme Regis. The earthquake of 1884 affected the whole of the South of England, from Brighton to Bovey Tracey in Devonshire, and fell with the greatest severity upon Colchester and the neighbourhood. Although the shock was felt in twenty-one counties structural damage was exclusively confined to Essex. At Peldon about 70 per cent. of all the chimney-stacks fell and several walls were shaken; the massive tower of the church, whose walls were nearly two feet thick, was cracked nearly from bottom to top. Of the fifty-three places which were visited by the earthquake, eight churches were more or less damaged, and three experienced violent oscillations. Colchester seems to have suffered similarly from the great earthquake of September 8th, 1692, which was felt throughout the whole of the east of England.

The last of this long series of volcanic energies which I shall notice will be the devastating shocks of December last, in the South of Spain, which must be fresh in the memory of every one ; the Spanish peninsula has been raised above the level of the sea at a comparatively recent period, for the elevated plain of Castile consists either of tertiary rocks or of pebbles derived from the detritus of older formations, probably by some other than volcanic agency ; the evidence of any igneous action being no nearer than the Pyrenees or Catalonia.

This earthquake which was of unusual violence, occurred on Christmas night, in the southern provinces of Spain, and in the neighbourhood of Madrid. The devastation was more terrible and wide spread in the south, being accompanied with great loss of life. There were five distinct shocks in Malaga three the following morning, and five on Friday and Saturday. The provinces of Malaga and Grenada, occupying an area of about seventy miles from east to west, and thirty-five miles from north to south, suffered the most. The mountain range of the Sierra Nevada, with its peaks of 11,000 to 12,000 feet above the level of the sea (the principal mass consisting of crystalline schists, flanked with Tertiary strata), touched the eastern portion of this disturbed district. The town of Alkama, which stands on the junction of the Tertiaries with the schists was almost destroyed. The shocks extended along the line of mountains as far as Gibraltar, Cordova, Cadiz, and Seville. No sea-wave was chronicled, which may be accounted for by the limits of the earthquake being confined to the sea-board.

Both in North Wales and in the Lake district volcanic work has taken place on a grand scale during the Arenig and the older portion of the Llandeilo periods, and during the deposition of the Bala and Caradoc beds, in Cambro-Silurian times. A series of grand volcanos rose along the line which now forms the Grampians in Devonian or Old Red-Sandstone times ; the Sidaws, the Ochils, and the Pentlands are remains of the great

lava sheets of volcanic agglomerates, ejected from these Devonian volcanos. Volcanic action seems to have become somewhat subdued during the Carboniferous period and instead of great central volcanos, we find small vents distributed about. It is not clear whether volcanic action had entirely ceased in the Permian age or not, but it certainly had in the British Isles during the Secondary age. Beyond the British area however, there are proofs of intense volcanic activity during the Triassic, Jurassic, and Cretaceous periods in the Tyrol, South Eastern Europe, and Western America. It returned in full force again in the Tertiary age, taking a north and south direction, instead of north-east and south-west. During the Miocene age a chain of volcanic mountains stretched north and south from the Hebrides to the north of Ireland, and occupied the sea which now separates Great Britain from Ireland. The intervals between the eruptions during this period were of long duration, as may be inferred by the forests and remains of animals which the intercalary beds contain.

In Central France there is a large tract in which indubitable marks of volcanic agency are exhibited, numerous hills being formed entirely of red porous cinders, surrounded by plains of black lava. There are three distinct mountain masses, Mont Dore, the Cantal, and the Mezin, all of which rest upon a granitic platform, at a height of about 6,000 feet above the sea, and which were doubtless the centres of volcanic action, shewing two distinct periods of volcanic activity. There is an extremely interesting and instructive example near Clermont of an alternation of successive basaltic currents with fresh-water calcareous deposits the beds of basalt being interspersed with volcanic ashes and scoriae. Of these three volcanic masses Mont Dore is the most considerable, attaining a height of 6,258 feet; its eight summits are comprised in a circuit of about a mile in diameter; no regular crater remains on the central summit, but that one has existed before the long and violent attacks to which it has been subject since the extinction of its

fires, may be guessed by the arrangement of the beds of which it is composed, dipping off from the central axis on all sides, and lying parallel to its sloping flanks, which are covered with enormous conglomerates, deep masses of which also lie at its foot. The peaks are crowned by more durable material, which have resisted the wear and tear of ages. Within the Mont Dore system there are also evidences of comparatively recent eruptions; of these the Puy de Tartaret is one, at the base of which is the village of Murol; side by side of this Puy is a conical eminence of ancient basalt, upon which is built the castle of Murol; there are two other recent cones close by, which seem to have exploded through a succession of basaltic beds. The eruption of Tartaret passed right through the granite base, and a superficial bed of basalt of an older date. It is fortunate that these two distinctly separated volcanic outbursts, one more ancient than the other, can by their juxtaposition be favourably examined and compared.

It appears probable that the elevation of Mont Dore commenced towards the close of the Miocene lacustrine age, whereas the larger proportion of the Monts Dôme and the Haute Loire, especially the latter, must be referred to a more eruptive epoch, probably the Pliocene age.

Spectrum analysis has revealed to us proofs that the more distant bodies of the universe possess the same elementary substances as those of our globe, and that meteorites do contain substances precisely similar to those which are sometimes brought from the interior of the earth during volcanic outbursts. The moon's surface shews evidence of volcanic disturbances, but these appear now to have entirely ceased, owing probably to the absorption of the atmosphere and water.

Some ancient volcanos have had their bases exposed to view by denudation; of this the Island of Skye is an example which was probably in eruption during Tertiary times; it had originally a diameter of thirty miles and a height of not less than twelve hundred feet; now nothing is left but highly crystalline granite

and gabbro, filling up the great fissures, through which the eruptive matter passed ; there are small patches of scoriæ and lapill, remaining, which escaped denudation. The Red Muntains and Coolin Hills, which are about 3,000 feet above the level of the sea are the remains of its original solid mass.

Much of our knowledge of the earth's crust is due to volcanic action. Upheaval and depression have been the means of bringing within our reach an investigation of the rocks which constitute it. The Bay of Naples presents a very favourable illustration of the alternation of the levels of the coast-line. In the third century B.C. it was on the descent, and continued so until the eleventh or twelfth of the Christian era, from which time to the sixteenth century there was a period of elevation, followed by another period of depression.

It has been fully shown how much the present configuration of the earth's surface is due to volcanic agency, from the earliest geological periods, when the mud was first precipitated to the bottom of the Laurentian seas, entombing the first organisms of animal life, to the date of the deposition of the Norfolk and Suffolk Crags. It is difficult to fix with any certainty what phenomena can be accepted in proof of the occurrence of this energy, or to assign them their place in any particular geological epoch. We have already seen, from instances in the Auvergne, how the geological periods of eruptions can be approximately fixed. I will cite Gorgovia, already referred to, where there are distinct proofs of lavas having been poured into lakes, and interstratified, and even mingled with the fresh-water and terrestrial spoils of the region. Strata are occasionally met with which have been subjected to violent dislocations, some of which have occurred subsequent to the eruptions of volcanic matter, showing injected masses of trap-rocks having been broken off from the surrounding beds, with which they have been previously solidified, and heaved upwards and downwards. We find these same districts

have been subsequently the theatre of violent earthquakes, causing faults and fissures.

There are instances of rocks having been forced upwards through a crust of superincumbent strata, from which it may be fairly inferred that some of the volcanic agents which caused the disturbance must have been in action after their deposition. When a circumstance like this occurs in the coal-bearing strata, valuable beds of coal are brought up to the surface which otherwise would be too far down for profitable working. The volcano might be viewed as a great natural means of destruction and renovation, while the earthquake which is its constant companion operates perhaps still more directly as an agent of change, by elevating some portions of the surface of the globe and depressing others, occasioning great rents in the strata and causing variations in the strength and direction of the tides, by which solid materials are transported to distant places. The geologist has to read off the evidences of eruptions and earthquakes amid the rocky monuments of the past, and note down violent disturbances in close approximation with metamorphic rocks.

There are no traces of subaerial volcanos in Great Britain, but the rocks of felspar, augite, horneblende, &c., prove the presence of heat and fire at some time or other. I do not wish it to be understood that the elevations and depressions of the earth's surface are wholly attributable to volcanic causes ; on the contrary, I believe they hold a very subordinate part ; the cooling and contractions of the earth may very much account for the shrinkage of the earth's mass, and may be regarded as a cause of the elevation of mountain chains.

In the old world the earthquake disturbances stretch along the tract of depressions and elevations lying between the Alps and the mountains of North Africa. They enclose the basins of the Mediterranean, the Black Sea, the Caspian Sea, the Sea of Aral, and rise into the great ridges of Central Asia.

The earth's crust is always undergoing changes of elevation,

which are scarcely perceptible until after a considerable lapse of time; of these may be mentioned the raised beaches, of which there is a remarkable instance at Portland, an account of which will be found in last year's volume.





Address of the President at the Annual Meeting of the Dorset County Museum.



THE County Museum has made considerable progress during the past year, valuable additions having been made both to its archaeological and natural history departments by gifts, purchases, and loans. One wall case, one standard case, and two table cases have been added to the furniture of the Museum, the special gifts of seven members. We hope in due course of time, through the generosity of others, to have sufficient appliances for a systematic and instructive display of our collections, such as to enable the scientist and student to go at once to the object which he desires to see, instead of having to look for it at hap-hazard. It is the intention of the Council to separate the Dorset collections from those which are derived from localities outside the county border. Our downs and hill ranges abound with evidences of man's occupation during prehistoric times. Mr. Warne's and Mr. Cunnington's collections, which are kept distinct, contain a rich series of the records of the remote past. We have various proofs in several parts of the county of the higher civilisa-

tion of Italy, introduced by the Romans, and of a subsequent Romano-British occupation, so grandly exhibited at Woodcuts in the neighbourhood of Rushmore, through the disinterment of a village of that period by General Pitt-Rivers, the spoils of which are deposited in his museum at Farnham. The towns and villages of Dorset vie with other counties in mediaeval architecture, of which may be named Corfe Castle, the Abbey Churches of Milton, Sherborne, and Cerne, Ford Abbey, Wimborne Minster, St. Catherine's Chapel (Abbotsbury), Bere Regis and Studland Churches, the mansions of Melbury, Hanford, Athelhampton, and Wolfeton. The present age is one of preservation and renovation, not destruction, as of yore. Antiquity is venerated, and a disposition fostered to place in safe keeping, like that of a public museum, an object on which the possessor places some value (such as a collection of his own formation), and is desirous of its preservation after he has passed away. It frequently happens that a collector's heir or successor, with no concurrent taste, or careless of his newly-acquired possession, will either allow it to remain in neglectful obscurity or to be scattered to the winds, a loss both to science and to the country. It is incontrovertible that England offers less favourable means for the acquirement of technical and scientific knowledge than our Continental neighbours offer to their youth, owing perhaps in some measure to the earlier period of the consolidation of England into one kingdom at the close of the Heptarchy, the capital towns of the previous petty kingdoms being then nothing more than fortresses and strongholds of tyranny and cruelty, whereas the consolidation of France occurred towards the close of the Middle Ages, when every capital provincial town had its Faculties of law, theology, medicine, and science, many of which survive to the present day. The County

Musuem is doing something in this direction under the inspiration of our gifted curator, Mr. Moule, whose sketching and geological classes are familiarising the young people of the town with the objective beauties of its environs, and with the subjective mysteries of some of the earth's history, of which no other English district can give more instructive illustrations. I refer especially to the great Ridgway fault, which is well exposed in the railway cutting between Dorchester and Weymouth, and is so clearly illustrated by Mr. Osmond Fisher's model in this room. Palæontology is not only the handmaid to the stratigraphical geologist, but is an important factor in the demonstration of the successions of life, showing the changes our globe has experienced with regard to climate, alteration of currents, of altitude or of sea depths, and during the period of deposition their combined influence on the distribution of animals and plants. Our well-filled cases give us some idea of life as it was in the old sea-beds, divested of its environment, from which a good idea may be obtained of what is going on at the present day and in its connection with the past, also the relation of ancient forms of living beings with those which exist now. Masses of facts are being daily accumulated which, when sifted and tabulated, will help to show that physical laws govern the succession and distribution of life as much at the present day as it did in the earliest stages of the earth's history. We have an almost perfect series of fossils obtained from this county, from the superficial gravels of the quaternary period down to the Liassic, which with all the intermediate beds are well exposed along the coast from Bournemouth to Lyme Regis, and in the quarries, escarpments, and railway cuttings inland. The clay beds of Lyme Regis, Kimmeridge, and Gillingham furnish us with the grand Saurian

remains exhibited in our cases and on our walls. The freshwater beds of Swanage furnish the *Goniopholis* or Swanage Crocodile, also a small dwarf Crocodile adapted for the diminutive mammalia upon which it preyed—a remarkable provision which was recognised by Sir Richard Owen, K.C.B., F.R.S., in 1871. These same beds supplied the fine series of Turtle and Fish remains in one of our cases, which will well repay a careful examination. There is evidence that the sea twice invaded this Purbeckian estuary, and established itself sufficiently long for the introduction of a marine fauna, amongst which was one Echinoderm, and one only, *Cidaris Purbeckensis*; it occurs in a very narrow band which divides two beds of oysters, called in their aggregate the Cinder-bed. It is my good fortune to be able to place one of these rare and beautifully-mammillated little urchins in the Purbeck case of the Museum. There are two fossils in one of the Tertiary cases which deserve to be mentioned. The formation to which they belong does not come to the surface in this county, its nearest outcrop being in the neighbourhood of Lyndhurst. They were found by a well-digger at a depth of 70 feet, at Holt, near Wimborne. Two valuable collections have been added during the past year to the geological department by the purchase of the late Mr. Summers' collection, which includes fossils from the Chalk, through the lower Cretaceous formations and the underlying Kimmeridge Clays of Stoke and Melcombe Park, to the Coral Rags of Haselbury Bryan, and that of our fellow member, Mr. Maggs' collection, which he obtained from the Cephalopoda beds and Sands of the Inferior Oolites of Sherborne and the neighbourhood. Both were acquired through the loyal generosity of friends by subscription. The most valuable and important acquisition of the year is that of the Warne Collection,

the munificent gift of the veteran Dorset antiquarian and archaeologist, Charles Warne, Esq. It is impossible to speak too highly of its value, especially as the greatest portion of it was obtained from this county. A perusal of Mr. Warne's various works in connection with the antiquities of the county, of which his "Ancient Dorset" stands pre-eminent, will induce a thorough appreciation of the value of this collection. The members are also deeply indebted to Mr. E. Cunnington, who walks in the path of his veteran fellow-worker, for the magnificent collection in the three cases which are furnished at his own expense and are standing in the centre of the room. They contain prehistoric British and Saxon relics of great value, and obtained by the indefatigable antiquary after much labour and expense. We are indebted, too, to a considerable number of donors and friends. Thanks will be given to each individually in the course of a few days. In future the committee hope to arrange for a prompter acknowledgment of thanks to the donors instead of the long interval between the annual meetings. In conclusion I will repeat the congratulatory terms I ventured to utter at the commencement of this short address, with the addition that it is my firm conviction that very much of our present popularity and success is due to the ability, energy, and industry of our curator (Mr. Moule), aided by similar devotion on the part of our sub-curator (Mr. Voss).—Reprinted from the *Dorset County Chronicle and Somersetshire Gazette* of January 14th, 1886.





Geology of Bournemouth.



HE British Eocene strata occupy, as is well-known two synclinal depressions in the Chalk known as the London and Hampshire basins. Although these must undoubtedly have once been continuous and have been separated by the upheaval of the underlying chalk, and by subsequent denudation, yet many of the beds are so local and there is such great variation, both vertically and horizontally, that it is by no means easy to correlate them exactly, since it is not possible to be certain that an apparently identical bed found in two detached sections really occupies the same horizon in both.* Until within the last few years the confusion in nomenclature and classification of the beds of the London and Hampshire basins has been extreme. This arose from the fact that the beds which were first examined and which gave their names to the series, those near London, are generally thin and barren representatives of

* How great this difficulty of correlation is, is well shewn in the discussion in the August 1885 number of the Q.J.G.S., on Mr. Irving's paper on the Aldershot Bagshots. Most of his sections shew a well defined bed of well rolled black flint pebbles in sand, forming the base of the Upper Bagshots. Were it not for the warnings of Professor Prestwich and Mr. Monkton I should be inclined to consider this bed as identical with the grey rolled pebble bed which comes between the Bournemouth beds and the Plateau gravel along the Bournemouth cliffs.

strata which in Hampshire and the Isle of Wight are four or five times as thick and exceptionally rich in organic remains. But since the careful labours of Mr. Starkie Gardner and Professor Judd in working out in detail the complete sections afforded by Bournemouth and Whitecliff Bays, and those of Professor Prestwich in comparing and correlating the three basins of London, Hampshire, and Paris, the previous chaos has been reduced to something like order.

As the results of their work are still chiefly contained in scattered papers, I have drawn out a tabulated comparison of the series, which will, I hope, be of use to those who, like the members of the Dorset Field Club, live in the richest of the three districts.

It will not be possible for me to-day to do more than refer very briefly to the rocks shewn in the Bournemouth cliffs, and to the general lessons which they unfold to us of the past history of this part of our island, referring those who wish to go into the subject more in detail, or to learn more of the rocks which do not lie strictly within the Bournemouth district, to the various Monographs, which are chiefly the following

Lyell, on Hordle Cliff, Geol. Soc. Trans. II.

Prestwich—on the London Clay and Bagshot Sands Q.J.G.S., vol. III.

„ on the Coast Section of Christchurch Bay Q.J.G.S., vol. V.

„ on the London and Hampshire Tertiary systems Q.J.G.S., vol. VI.

„ Correlation of the Eocenes of England, France and Belgium Q.J.G.S., vols. XI & XII.

J. S. Gardner—on the Bournemouth Beds Q.J.G.S. XXXV. and XXXVIII.

„ „ Geological Mag., Jan., 1877, & April, 1879.

„ on the Lower London Tertiaries Q.J.G.S. XXXIX. Nature, 1877, & Proc. Geol. Assoc., vol. V.

Professor Judd—on the Hampshire Oligocene Strata Q.J.G.S., vols. XXXVI. and XXXVII.

Messrs. Tawney and Keeping—on Hordle Cliffs Q.J.G.S. XXXIX.

Mr. W. Monkton—on the London Bagshot Beds XXXIX.

Rev. J. A. Irving—on the Aldershot Bagshot Beds XLI.

Rev. O. Fisher Q.J.G.S., XVIII—on the Bracklesham Series of the Isle of Wight.

Prof. Duncan Q.J.G.S., XXVI.

Mem. Geol. Survey—Bristow, Geol. of Isle of Wight.

„ Whitaker Geol. of London.

Palæontographical Soc.—British Eocene Flora.

Boyd Dawkins—Early Man in Britain.

First, I propose briefly to pass in review the Cliff Sections of Bournemouth. The Bay is bounded at either end by the Chalk of the Old Harry Rocks and of the Needles, which were undoubtedly once joined by a prolongation of the high Chalk Downs of the Isle of Wight and of the Isle of Purbeck. As their elevation took place after the deposition of the overlying Tertiaries, these latter were pushed up by the rise of the Chalk, from the higher parts of which they were afterwards denuded, so that the lower beds are now found with their upturned edges forming the surface of the ground at the foot of the slopes of Ballard Down and High Down.

In Studland Bay we shall find that as is usually the case, the Tertiaries seem to rest conformably enough on an eroded surface of Chalk, yet there can be no doubt that a very considerable time must have elapsed between the Cretaceous age and that of their deposition. Although the green-coated flints, which are generally found between the Chalk and the Tertiaries, must have been dissolved out since the latter were laid down, so that the surface on which they now rest is not that on which those beds were actually deposited, yet there are many indications that the bottom of the early Tertiary sea was a bare surface of Chalk, like that which now forms the bed of much of the English

Channel. Further North in the shallower and more troubled waters of the London Basin, this was probably covered by great beds of fucoids and *Laminariæ*, which may have given its peculiar character to the blackish green mud of the base of the Thanet Sands.*

But these estuarine formations are wanting in our neighbourhood and deeper sea conditions seem to have prevailed from the first, so that the Plastic Clay of Studland represents the whole of the varied series of the London Basin from the Thanet Sands to the London Clay. Since its deposition it and the overlying beds have been tilted up by a great fault in the Upper Chalk, so that their lateral extension has been plunged vertically downwards and only their thickness or edge exposed. On this edge of the Plastic Clay, the village of Studland is built. The little spot is famous for its beauty, a beauty which it owes to the splendid timber which here, as elsewhere, grows on this formation. The Plastic Clay runs in a narrow belt by Lancing and Arundel to Botley, near Winchester; two miles south of Salisbury, thence by Wareham, past Dorchester, and through East Lulworth, Studland and the Isle of Wight by Alum and White Cliff Bays, where the whole Eocene series is found in its fullest development.* It occurs again on the hill tops overlying the Chalk at Marlborough, and runs by Pangbourne, Reading, Sonning, Twyford, Maidenhead, Taplow and Burnham Beeches, and is found again in Buckinghamshire, at Beaconsfield and Amersham, and at Chiselhurst in Kent. Wherever it runs, there are sure to be found some of the finest trees in England. At Studland the only fossils appear to be fragments of vegetable matter, but in the corresponding beds at Woolwich and Bromley are found an estuarine *Cyrena*, which still lives in the Nile, and great banks of oysters, and the underlying Thanet sands of Herne Bay are full of Bivalve Mollusca.

Passing on towards Poole and leaving the red and yellow

* Q.J.G.S. VIII., Prestwich, xxxix., Gardner.

sands of the Plastic Clay which form the low cliffs at Studland, we come to the London Clay, whose surface is overgrown with gorse and brambles. In England it runs almost always side by side with the Plastic Clay and is largely developed in the district round London, where it forms an undulating country which until recent times has been thickly inhabited only on its sharper slopes, the lower and flatter tracts being generally damp and cold, and, from the lack of permeable beds, deficient in good water supply except by sinking deep wells.

The formation, as is usually the case, is at Studland a blue clay, weathering brown from the oxidation of the Ferrous Sulphate contained in it, and unfossiliferous except for traces of vegetable matter. But in the Isle of Sheppey the palm tree nuts and the numerous remains of turtles, tell the same tale as the Cyrena and Oysters of the Woolwich beds, and shew that the formation must have been laid down in the estuary of a great river flowing eastwards through a tropical land.

Just after leaving Studland village, we find ourselves on a series of fossiliferous freshwater sands and pipeclays which extend inland as far as Corfe and Branksea, and are largely dug for pottery and sent even to Staffordshire. These beds are the same as those exposed on the opposite side of the water at Alum Bay, and like them have yielded an abundant Flora, chiefly in detached leaves of forest trees mixed with masses of large Fan palms and Ferns, whilst the greater frequency of insect cases and shells would imply that the water into which they drifted was nearer to land than that in which the overlying Bournemouth sands were deposited. These beds, which are of Lower Bagshot age, were included by Prestwich in the Lower Bracklesham, but are now better called the Studland series. After crossing the mouth of Poole Harbour we come to the Bournemouth Freshwater sands and Brickearth corresponding

* Professor Judd, Q. J. G. S., xxxvi. and xxxviii. and Prestwich II, where complete Section is given.

to the middle Bracklesham sands further east, both of which, however, are of entirely marine origin, whilst these beds, which extend as far as the landslip under the "Manor Plot," were deposited in perfectly fresh or very slightly brackish water.

At the very base of the cliffs, generally covered by the beach, but sometimes uncovered at low water, is a thick bed of ironstone and lignite. It is best seen near the Martello Tower at the end of the Branksome estate. It is there thick enough to form a genuine bed of bituminous coal. Above it comes a bed of blue clay about 10 ft. thick full of thin layers of lignite, small plates of mica and bands of coarse quartz-grit and sand, sharp and angular. Further back, towards Studland, this grit becomes coarser and thicker and the remarkable block called the Agglestone is simply a mass of it worn into the shape of a pyramid standing on its apex by the sand blown along the surface of the ground. Above this bed of dark clay comes a very variable series of sands and clays, generally light in colour, and containing most beautiful fossil leaves, flowers, and fruits, best preserved in the firm white pipeclay. Each species is generally limited to a very small basin, as if the leaves had fallen into the still water of a lake or the backwater of a river, from trees growing on the banks, and had sunk where they fell. "The Western portion of the cliff section presents us with the older beds, and these contain principally leaves of dicotyledonous forest trees; the central area adjoining Bournemouth Pier abounds in Palms, Ferns, &c., while to the east we see marsh or swamp vegetation, and finally fruits, seeds, and branches, which have been floated out to sea. The occurrence of leaves attached to branches, of insect remains, and of a feather, seems to indicate proximity to the shore. In one basin just east of Sugar Loaf Chine where are a great number of small willow-like leaves, any of the species found also in other beds are stunted and dwarfed. It would seem therefore as if the Western beds presented the remains of a comparatively upland Flora shed from

luxuriant forests, while these grew on the more barren tracts lying between them and the palm-bearing swamps near the open sea. Beyond the Pier a bed contains Ferns, Aroids, Fan Palms, a *Eucalyptus*, and a Sequoia-like Conifer which from the complete absence of cones, the similarity of foliage, and the association of plants, may perhaps be referred to the swamp loving *Podocarpus*. The last freshwater beds met with contain the remarkable forms referred to the Polypodiaceæ. They, with other Ferns, Rushes and the Conifer already mentioned indicate a swamp vegetation. Thus by the plants may be traced the change from hill to valley, and from valley to marsh.* ”

Here and there occur lenticular patches of darker clay, often with trunks of trees. In one place just above the lignite beds three large trunks might be seen in 1876 projecting from the cliff, lying in the midst of a tumbled mass of sand and clay and iron pyrites, overlaid towards the east by a great heap of broken lumps of pipe-clay mixed with sand, while towards the west the mass had been cut through after its first deposition, and left with a steep face, against which clays and sands had afterwards been more quietly laid down.

The whole series of beds is most varied and irregular; but on the whole the bands of lignite and pipe-clay and sand slope slightly towards the east in roughly parallel zones, offering just such a sequence of horizontal stratification as would be found in the bed of any large river, such as the Rhone or the Mississippi. I have already mentioned that the quartz-grit grows coarser towards the west; the general slope of these variable bands of sand and clay also indicates a current flowing from the west, the bed of lignite, the raft sticking out from the cliff, and the lenticular patches of clay with the steep slopes towards the west shew that a scooping force acted against them from that direction after they first sank to the bottom, and the

*J. S. Gardner, Eoc. Flora Pal. Soc. 18.

more we examine, the more reason we shall find to believe that all these Tertiary beds from the Plastic Clay upwards were deposited in or near the estuary of a great river taking its rise in the granite mountains of a continent stretching away to the west and north-west, whose relics form the hills of Cornwall and Brittany.

If this be so we ought to find these leaf-bearing freshwater beds gradually assume a marine aspect. And so we do. Mr. Gardner has shewn that from the landslip under the Manor Plot, as far as High Cliff, the beds are no longer freshwater but marine.

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Mr. Gardner divides them into four sections—the Lower Marine series, the Upper Marine Series or Boscombe Sands, the Hengistbury Head Beds, and the Highcliff Sands.

The change from freshwater to marine conditions occurs somewhat suddenly just where the clay which once formed the slimy ooze of the river mouth sinks under the surface of the shore, and the overlying beds have slipped over it, forming a kind of undercliff just below the Manor plot. Owing to this slip the section is seldom to be clearly seen, but Mr. Gardner dug it out, and describes the beds as “exhibiting an extraordinarily shifting and changing character both horizontally and vertically while the marshy character of the vegetation, as represented by Ferns, Eucalyptus, Aroids, &c., the frequent patches of drab clay which evidently once formed an oozy soil in which the ferns and perhaps water plants rooted, the local patches of ironstone, the marine beds, as well as the character of the fauna, shore crabs and Callianassa, mingled with Unios, clearly shew that this was the actual debateable margin betwixt sea and river, beyond which to the west it seems clear the encroaching sea never in those ages penetrated.”*

West of this point but little *Teredo*-bored wood is found, while east of it there is a good deal. The great lignite beds

* J. S. Gardner, Q.J.G.S., xxxv., 227.

show no signs of boring, and the little that is found must either have worked its way up with the tide, or may have been the work of the freshwater species; west of it the beds are coarser, and there is more quartz-grit than to the east; westwards I have found no gypsum, eastwards it is common; westwards the beds are most irregular, and full of the false bedding caused by a rapid current, while eastwards they may be traced with but slight variation for miles; lastly, to the east the beds are covered by a bed of well-worn rounded flint shingle, of which there is no sign to the west.

The lower marine series can be traced all along the shore nearly as far as Hengistbury Head, where they dip under. Above them is the regular series of the Upper Marine beds or Boscombe Sands, which are unfossiliferous, and are capped by one or sometimes two beds of large round grey flint pebbles, whose eastward slope, like that of a shingle beach, shows that they were thrown down by water advancing from that direction. Above these at Hengistbury Head are two or three irregular beds of sand and ironstone, which seem also to be a shore deposit, and above them again the white Highcliff Sands, which form the top of Hengistbury Head, and the base of the cliffs on the other side of Christchurch Harbour.

These Highcliff sands, which are quite conformable with the overlying Barton and Hordle series, have furnished me with a considerable number of fossils of the Barton type—*Voluta*, *Fusus*, &c., but all stunted as if they had lived in somewhat brackish water, which is just what we should expect. Above them comes the Barton Clay, which, according to Professor Judd's classification, now pretty generally adopted, is the highest member of the English Eocene. There is no need to describe its well-known fossils in detail. They tell of a state of things not very unlike that of the London Clay of Sheppey, but with a climate warmer than it had been then, warmer also than is declared by the beds which overlie the Barton clay, and which Professor Judd refers to the Oligocene of the foreign Geologists.

Before speaking of these beds, it may be well to review the data which we have acquired thus far as to the Physical Geography of the Eocene period.

We have seen that all the beds of the Bournemouth shore, above the London clay, tell us one after another, of having been deposited in the bed, or back waters, or deserted pools of a great river flowing from west to east, or else in the brackish waters of its estuary or in the muddy sea near its mouth.

We have seen also that this river must have flowed from higher ground covered with dicotyledonous forest trees, then through a more barren district of willows and stunted bushes, and at last have run out to sea through a swamp covered with a jungle of Ferns and Palms.

Further, the quartz grit and fine sands and pipe-clays generally free from flints, shew the land through which this river ran to have been one of granite mountains and not of Chalk hills or cliffs, and it must have been no small district which it drained, but a large continent, for the width of the stream cannot have been less than a mile, and the breadth of its valley subject to floods, at least nine and possibly sixteen miles. Its deposits stretching as they do from England over France, show it to have been probably as large as the Amazon. During floods, trees were torn up by the roots, just as they now are by the Mississippi, and came floating down the stream till they sank water-logged to the bottom and helped by their mass to divert the river into a new channel, while the old one became one of many pools into the fine silt of which the leaves of the fringing trees quietly settled down. The general facies of the flora is extremely like that of tropical Atlantic America, and while the river probably rose in a mountainous country formed by the granite mountains of Brittany and Cornwall joined, and vastly higher, then than now, the continent itself stretched across the North Atlantic and joined the British Isles to North America by continuous land of which Greenland, Iceland, Rockall and the Faroe Islands are the only parts now left above water. Many

facts point to the former existence of this continent, the shallow soundings, the American relationships of the fossils, the tropical climate which they indicate and which would be at once caused by such a belt of land shutting out all the cold northern waters from the Atlantic, and lastly the migrations of certain Arctic birds, principally geese and wagtails. Whilst the majority of the species simply travel down the coasts of Norway and Russia towards the south, others make a great detour to the north of America, coming down by means of long trans-oceanic flights by Greenland, Iceland, and the Faroe Isles. It has been supposed that these also at first simply travelled down the coast of the now vanished continent, their sea flights becoming longer and longer as the land sank beneath the waves.

The sea into which this river flowed can hardly have been deep, nor very extensive. It must have been shut in from the north and open to the south and east, but it is probable that it was nearly or quite divided into two by a long island or isthmus running S.E. and connecting what we may call Atlantis with Europe. The shingle beds of Blackheath, the estuarine remains of Woolwich and the palm fruits and turtles of Sheppey, which all point to coast conditions, were probably formed on the shores and in the mouths of small rivers belonging to this island or isthmus, running across the weald of Kent towards Belgium and most likely marking the last remains of the old ridge of Palæozoic rocks, which had formed a mountainous island in the Oolitic sea, but which is now completely buried and hidden beneath the later rocks. One of the little streams which drained this island ran out between Charlton and Woolwich, another near Newhaven, and while to the west, near Blackheath, the shore was shingly, further east in the Isle of Thanet, was a low marshy swamp, often covered by the sea, in which flourished palms of the genus *Nipa*, in whose dark groves lived a kind of Hog with enormous eyes, whilst turtles and water snakes crawled in the slime, and the waters teemed with sharks, rays, and crustacea.

This isthmus varied somewhat in position from time to time, possibly being partly a shifting bar or delta to the great river, and generally speaking, the waters to the north of it, as represented by the London clay, contained, as we might expect, a fauna of a less tropical character than those to the south, which is to be found in the fossils of Bracklesham, and the exquisite remains of the corresponding Calcaire Grossier of the Paris basin.

For a long time the sea bottom appears to have slowly subsided, so that the depth of the water remained nearly the same probably less than a hundred fathoms, in spite of the quantity of silt poured into it. But after the Barton Clay which marks the close of Eocene times, this subsidence appears to have been arrested, and the limit between freshwater and marine conditions is to be found further to the east. The Oligocene beds of Hordle and the Isle of Wight, which were laid down almost entirely in fresh or brackish water, tell us of later times, when what had been the low lying reaches of the river had become a broad plain full of lakes and lagoons, possibly not unlike the flat tracts on the lower Rhone, but far more fertile.

After these beds comes a gap in the Geological story in this part of England, for between the age of the thin bed of rolled grey gravel which caps the Bracklesham series in the Bournemouth cliffs and the thick red gravel which overlies it, the whole face of the earth had been changed ; for the Miocene age had come and gone and given place to the Ice age.

During the Miocene period, the Alps were raised at least 10,000 ft., and the chalk and overlying rocks of Southern England were thrown into those parallel folds or ridges which we call the Downs and much faulted in the process, as we may see in the cliffs near Swanage ; while in the North, the Hebrides were a mass of volcanoes, whose lava streams and all of whose old land surface has been so worn down since then that what was at first the bottom of a valley, has become a lofty mountain

—(The Scuir of Eigg)—yet here and there as in * Mull, fossil leaves and insects have been preserved, and in Central France we have a district which has never been under water since and from which we may well imagine the general aspect of Miocene Europe if in place of the pine and beech which now clothe the hills we put a far richer flora of sub-tropical character and almost precisely like that of the Pacific Coast of America and Japan, containing many species of Maple, the American Plane with its peeling bark, the Japanese Cinnamon and Cypress, and the Californian Vines and Sequoias and Fan Palms. Probably these trees, like many of their modern representatives, were not deciduous, but evergreen. But as time went on, the climate grew cold and these American cousins of our present trees retreated eastwards across Europe and Asia, and the land which then occupied the North Pacific to their present habitat. And as they retired before the growing cold, so did the plants which have taken their place, come down from the high latitudes where they had hitherto lived. And when these had established themselves in Europe, the whole winter aspect of the land was changed, for these inhabitants of the Pole, accustomed to a year half day, and half night, had acquired the habit of dropping their leaves before taking their six months' sleep, a habit which they even now retain in these more sunny climes. As the cold increased they too retreated southwards, and the waters rose round England, and much that till now had been dry land was submerged. All that we have to tell us of that time are the crag beds of Norfolk, where the steadily increasing proportion of Arctic shells proclaims the growing cold, while the overlying forest bed with its roots of fir trees tells how even the deciduous trees had left our land, which went on sinking and growing colder till all Scotland and North-western England was buried

* If, as Mr. Gardner thinks, the Bovey Tracey leaf beds are on the same horizon as the Bournemouth beds, instead of corresponding with the Molasse or Oligocene (Lower Miocene) of Switzerland, these Mull beds, and the volcanic rocks in which they are interstratified, must also belong to Eocene times.

beneath a sheet of ice, as Greenland is at present, which ground down and rounded off all the hills, and scratched all exposed rocks with long parallel striae in the North, while in the South, where it was partly replaced by a cold shallow sea, rain and rivers, coast ice and shore currents wore away the carpet of Tertiary rocks from off the ridges of the chalk hills and left them lying only in the hollows in the three detached pieces which we call the London, Hampshire, and Paris basins.

When the climate grew less cold and the ice began to vanish into vapour, torrents of rain must have been the result of the contact between the frozen earth and the warm moist air, and this rain soon carried the Tertiary gravels and clays off the hill sides down into this lagoon, where the water was too cold and too brackish for either freshwater or marine life, but where in winter coast ice formed and, stranding in the spring, twisted and contorted the clays and gravels which formed the bottom. Several of these contorted patches may generally be seen along the cliffs in the red gravel, which is known as the High or Plateau gravel, and is found crowning the high ground all round London, as well as at Bournemouth. Wherever it occurs, it has the same character of a sub-angular river gravel rearranged in a shallow sea. It may be distinguished from other gravels by the presence in it of a large number of quartz pebbles, derived from the granite mountains of that old Eocene continent of which we have said so much.

After a time the climate seems to have become cold again and a second Ice age, less severe than the first, came on, and then as it disappeared, came a second rainy period, when, as before, the rivers became of enormous size and an immense amount of denudation took place. But by this time the surface of England had acquired very nearly its present configuration, although it still formed part of the Continent, and the rivers, though much larger than now, ran pretty nearly in their present valleys. Thus a great stream occupying the position of the Avon ran past Christchurch under High Cliff, where Cliff-end forms the

brow of its banks, to join a mighty river which flowed west, where the English Channel now is.

It cut through and re-arranged the old Plateau gravel ; and the low cliffs which reach from Sand hills to Cliff end, round Muddiford Bay, are I believe composed of the gravel thrown down by this prehistoric Avon. It resembles the Plateau gravel in containing quartz pebbles and in its general aspect, but it is much less consolidated and much less impregnated with iron. Above it, along the ridge of Cliff-end are some beds of greenish clay which look like the loess or flood loam of this river. Flint implements have been found in the Plateau gravel, but not so far as I know in this later gravel.

I have said that this river flowed into another running westwards along the English Channel. Time will not allow of my giving all the proofs of this in the existence of shingle banks in mid-channel, from one of which the freshwater mussel has been dredged up. Nor can we go into all the various changes of level which are told of by raised beaches and submerged forests along our coasts. Suffice it to mention that one of the former may be seen behind Double Dykes not far from the edge of Christchurch harbour, while off Bournemouth pier and in the peat bogs of the Bourne valleys are remains of a great forest, chiefly of Alder and Willow. As time went on the land sank and about 9,000 B.C. the coast line was probably near where the 10 fathom line runs, about four miles from the present shore, just beyond the Needles and the Old Harry rocks, which must then have been joined by a range of Chalk hills. Since that time we may consider that the land has been nearly stationary and that the encroachment of the sea has been the cause which has slowly worn back the coast line to its present position.

COMPARATIVE TABLE OF THE TERTIARY STRATA
OF THE LONDON AND HAMPSHIRE BASINS.

According to Professor JUDD and Mr. J. S. GARDNER.

LONDON BASIN		HAMPSHIRE BASIN
Wanting.		Wanting.
Upper Oligocene		
	Upper London Tertiaries	
	Upper L. Tertiaries	Fossils, but with a rich fauna and flora in the estuarine swamp deposits of Sheppey.
	Bognor Beds. sands and pebbles.	Not found nearer than Portsmouth.
	Oldhaven Beds	Wanting.
	Lower London Tertiaries	
	Oldhaven Beds	Reculver Sands. a shore deposit, broken shells, few perfect, <i>Cytherea</i> , <i>Protocardium</i> .
	Woolwich and Reading Series	Shingle Beds of Blackheath.
		Woolwich and Charlton estuarine sands with <i>Melania</i> , <i>Cyrena</i> , &c. Plastic mottled clay of Reading, fluviatile or estuarine, unfossiliferous or with lignite.
		Thanet Sands. Marine, <i>Cyprina</i> , <i>Corbula</i> . Rochester. Herne Bay.
Lower Eocene		
		Mottled Clay.—Studland and Alum Bay, unfossiliferous. Fluviatile.
		Wanting.

brow of its banks, to join a mighty river which flowed west, where the English Channel now is.

It cut through and re-arranged the old Plateau gravel ; and the low cliffs which reach from Sand hills to Cliff end, round Muddiford Bay, are I believe composed of the gravel thrown down by this prehistoric Avon. It resembles the Plateau gravel in containing quartz pebbles and in its general aspect, but it is much less consolidated and much less impregnated with iron. Above it, along the ridge of Cliff-end are some beds of greenish clay which look like the loess or flood loam of this river. Flint implements have been found in the Plateau gravel, but not so far as I know in this later gravel.

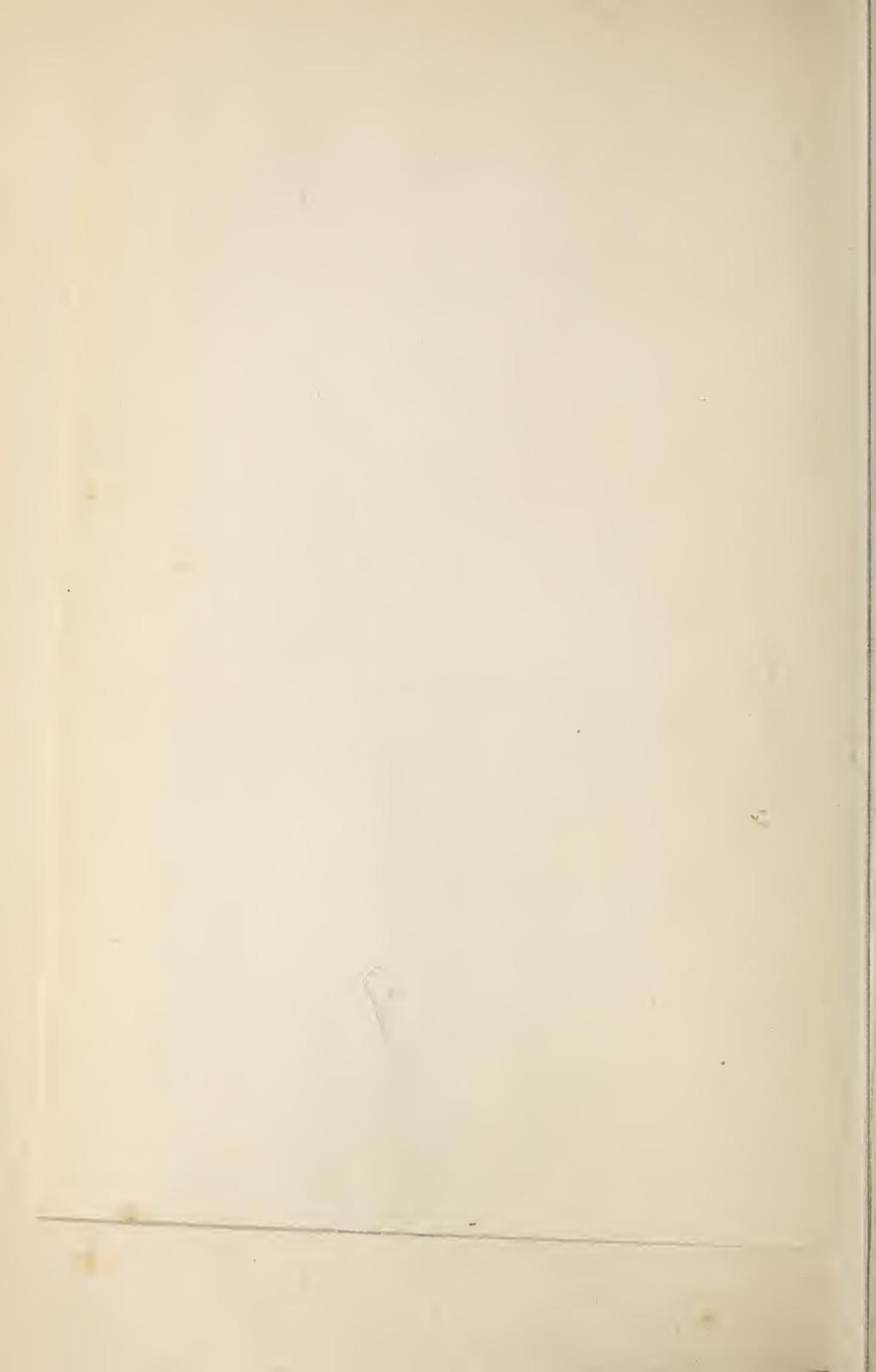
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COMPARATIVE TABLE OF THE TERTIARY STRATA

OF THE LONDON AND HAMPSHIRE BASINS.

According to Professor JUDD and Mr. J. S. GARDNER.

LONDON BASIN		HAMPSHIRE BASIN	
Wanting.		Wanting.	
Upper Oligocene		Hempstead Series. Marine	Corbula beds
Middle Oligocene	Wanting.	Bombridge Group.	Cerithium beds Upper Bembridge Marls.
Lower Oligocene	Wanting.	Estuarine.	Bembridge Limestone.
Upper Eocene	Upper Bagshot Sands, about 150 ft., Marine—Almost unfossiliferous (Mr. Gardner reckons these as belonging to Middle Eocene).		Lower Bembridge Marls.
Middle Eocene	A similar, but not necessarily corresponding pebble bed separates Upper and Middle Bagshot in Berkshire.	Headon Hill Clays. Estuarine Headon Cliff Section.	(All the beds above this are found only in the Isle of Wight) Brockenhurst beds.—Marine. There is a break between these and the underlying beds, but the latter pass quite imperceptibly into the Barton clay.
Lower Eocene	Middle Bagshot Clays, Marine, few Fossils, 50 ft. thick.		Sands and Marls, Freshwater 20 ft.
	Lower Bagshot sands. Freshwater, unfossiliferous about 150 ft. thick.		Marine bed (no longer visible) 1 ft.
			Shelly Marls 20 ft.
			Limnean Limestone and Marls 45 ft.
			Crocodilo sands, Freshwater 15 ft.
			Leaf bed—brackish 3 ft.
			Mammalian Sandstone estuarine, 20 ft.
			Lignite bed 4 ft.
			Headon Hill Sands, 200 ft at Whitecliff Bay. 30 or 40 at Beaton Bunny and Longmead End, Brackish water—Shells generally emarginated, but tolerably complete in a band near the top—Passage beds from Barton marine to the freshwater conditions of the overlying Headon Hill Clays. Barton Clay, marine.
			Green sandy clay—Passage beds from brackish High Cliff sands to marine Barton Clay 10 ft.
			Highcliff Sands—Brackish water about 60 ft. stunted fossils. These Sands, the Hengistbury, the Boscombe, and Bournemouth, Marine series belong to the Upper and Middle Bracklesham of Prestwich, and are the western equivalents or extreme shore conditions of the Bracklesham sea. Gard. Q.J.G.S. xxxv. 210.
			Hengistbury Head beds with Ironstone, Teredo borings, and vegetable remains 45 ft.
			Roll'd grey pebble bed.
			Boscombe sands, light colored sands & rolled shingle. Marine, 100 ft. slightly fossiliferous. Teredo borings.
			Bournemouth Lower Marine beds about 80 ft., dark sands and clays. Crustacean, Nipodites, Oysters, Dryandra.
			Bournemouth Western: Freshwater sand. Highly fossiliferous 450 ft. thick
			Central: Forest Trees. Palms & Ferns. Eastern: Marsh Plants.
			The Bovey Tracey beds belong to this series and were deposited in a detached lake.
			(Lower Bracklesham of Prestwich—name abandoned by him Q.J.G.S. xxviii. 470.)
			Studland Series. Freshwater sands and pipeclays of Studland, Corfe, Branksome and Poole. Leaf beds of Alum Bay, about 100 ft. thick.
Upper London Tertiaries	London Clay, Marine. Generally poor in fossils, but with a rich subtropical fauna and flora in the estuarine swamp deposits of Sheppey.		Studland. Traces of vegetable matter, otherwise unfossiliferous.
Lower London Tertiaries	Bognor Beds, sands and pebbles.		Not found nearer than Portsmouth.
Oilhaven Beds	Reculver Sands. a shore deposit, broken shells, few perfect, Cytherea, Protocardium.		Wanting.
Reading Series	Shingle Beds of Blackheath.		
Woolwich and Charlton	Woolwich and Charlton estuarine sands with Melania, Cyrena, &c. Plastic mottled clay of Reading, fluviatile or estuarine, unfossiliferous or with lignite.		
Woolwich and Reading Series	Thanet Sands. Marine, Cyprina, Corbula, Rochester. Herne Bay.	Mottled Clay.—Studland and Alum Bay, unfossiliferous. Fluviatile.	
			Wanting.





ON THE
Punfield Beds & Punfield Gove,
Swanage Bay, Dorset.

By M. G. STUART, M.A., F.G.S.



HE English Geologist is often wont to congratulate himself on the fact that within the comparatively narrow limits of this island is contained an almost complete series of the whole geological succession of sedimentary deposits hitherto discovered. Such a fortunate occurrence of conditions cannot be established in any other country of the world except under far wider limits of area.

In like manner we, the inhabitants of Dorsetshire, may feel some degree of satisfaction in the long and unbroken series of Secondary and Tertiary rocks which we possess, and the strikingly fine sections which are exposed along the seaboard of our county; whose area, compared with that of other counties of England, cannot be said to take a very high position. We are many of us familiar with the grand sections of Liassic beds exposed in the neighbourhood of Lyme Regis, which have been so prolific in Saurian remains, now preserved in numberless

museums; of the Oolitic sections of Bridport and Burton Bradstock; of the Kimmeridge and Oxford Clays in the neighbourhood of Weymouth and Ringstead Bays; of the Portland Beds of the Isle of Portland and Chapman's Pool; of the Purbeck beds forming their store of economic wealth surrounding us here in the neighbourhood of Swanage; of the Wealden Beds adding colour to the scenery of the bay and standing in contrast to the white cliffs of the Upper Chalk beyond, which, rising from the sea to a great height, streaked with dark lines of flints and showing lines of fault, and broken now into isolated masses of the Old Harry Rocks through the ceaseless influence of the weather and the sea, form as characteristic a section of that formation as could be found in the British Isles.

It is not, however, to these prominent features in our coast scenery that the present paper refers, but to a comparatively insignificant series of beds occurring in the cliffs of a minor indentation on the north side of Swanage Bay, known as Punfield Cove, which might be easily passed over by anyone unaware of their existence.

These beds, occurring as they do just above the Wealden Series, consist, briefly speaking, of an alternation of yellow sands and clays, with thin bands of more or less impure limestone, attaining a thickness of perhaps 200 feet. They were first noticed by Sir Charles Lyell in 1851 in his "Elements of Geology," in which he figured one of their most characteristic fossils, and drew attention to their bearing on the theory of geology. Subsequently they were described in detail by Professor Judd in the "Journal of the Geological Society" for 1871, when their characteristics were noticed, and an account was given of sections occurring in other localities in the county and elsewhere. Ten years ago, in company with our President, I had the satisfaction of spending some days in working out the natural history of the Swanage neighbourhood; and of these one day was devoted to the botany of the Littlesea district, and one to the geological character of Punfield Cove. We were

then fortunate enough to discover one of the typical fossils of the lower beds, *Vicarya Lujani*. This specimen was forwarded to the museum in Jermyn-street, but I regret to say that it has subsequently become broken and destroyed.

The Punfield Beds, by their character and organic remains, show that they are of fluvio marine origin, indicating thereby a gradual transition from the freshwater conditions under which the Wealden Beds were deposited to the purely marine character of the Neocomians above. Beds of this nature are of increasing interest to the geologist as our knowledge widens and we obtain larger views of past epochs in the world's history.

As an example of geological reasoning our little group of Punfield Beds in question is admirably suited. Amongst those who attend the meetings of our Field Club are many who, though interested in the science of geology, have often not sufficiently mastered the various branches of the subject to recognise the soundness of the grounds on which the argument is based. The mere examination of a group of beds *in situ*, the tracing of sections, or the discovery of a few specimens of fossil remains, which latter point is so often considered to be the real business of the geologist, the end rather than the means to the end, these are all we can hope to effect in the short time at our disposal during one of our meetings in the country. The mere collecting of fossil remains, however, will be of little help to us unless we have made ourselves acquainted with something of the character and habits of animals and plants living at present upon the surface of the globe; and since the mollusca, or shell-bearing animals, are those which are most frequently preserved in a fossil condition, it is essential to a right interpretation of the character of the beds we are endeavouring to study that we should understand the character of the group of molluscs embedded in them, if molluscs do in that case form the most important group of fossils—whether they lived in sea water, or whether they belonged to a family which inhabited freshwater; whether they frequented areas at great depths

beneath the surface, or whether they were restricted to the proximity of the coasts; finally, whether the conditions under which they lived were favourable to their free development, or whether under some adverse circumstances their growth was retarded and they became stunted and dwarfed and unable to attain to their full stature.

There are certain characteristics which lead the geologist to infer the origin of the deposits he is examining. The occurrence of numerous plant remains is considered the indication of the proximity of land, since marine plants, owing to the soft and perishable nature of their tissues, are not often found fossilized, whilst remains of plants growing on the land surfaces will not be found to have drifted, under ordinary conditions, to any great extent from the spot on which they grew, though notable exceptions to this are found at the mouths of existing rivers up to the present day. The occurrence of fossil remains of mammalia, reptiles, and amphibia, points to the proximity of land for the same reasons, and the character of the group of animals and plants found inhabiting the swamps and deltas of tropical rivers at the present day, such as the Mississippi, the Amazon, and the Ganges is especially instructive on this point.

I have deviated from the path for the purpose of pointing out the grounds on which the argument is based with regard to these beds of Swanage Bay, and from which the physical geography of the surrounding area at that epoch of the earth's history is inferred. The data above alluded to are as sound and unquestionable to the mind of the geologist, as the discovery in the Fayoom Valley of the Papyri and the description of their contents we have lately heard of, are to the Egyptologist of the gradual dissolution of the Roman Empire.

Formerly, when geological science was still in its infancy, investigators were inclined to devote their attention almost entirely to the formations of marine origin, and to describe their fossil contents, believing that a clearer history of the various changes occurring on the surface of the planet could thereby be

arrived at, such deposits as by their organic or lithological characters pointed to an origin other than marine were considered to be comparatively valueless to the end in view, and to be hastily passed over as too insignificant to attract notice. Of late years, however, a change of opinion has taken place from the accumulation of recorded investigations of beds in different localities, and an increased attention is being paid to deposits which give evidence of terrestrial conditions, or in other words, of their being deposited under freshwater estuaries, or in close proximity to continental areas. It was Professor Huxley who first drew attention to the fact of the increasing magnitude and importance of these deposits, and established the necessity of constructing two parallel series of beds in ascending and descending order, one for those of purely marine origin, the other for those of either freshwater or estuarine origin.

It is scarcely necessary, with the limited time at our disposal, to do more than refer to the importance of these views on the theory of Geological science, and their influence in arriving at the right appreciation of the changes which have taken place over the surface of the earth. It will be more appropriate to pass on from these general observations to the consideration of the position which the Funfield Beds themselves occupy, and the facts which they have to teach us.

We know that the important formation of the Oolites, with its various subdivisions of limestone, and two important beds of clay, extending over a vast area and of a great aggregate thickness, was essentially a marine formation; on reaching the uppermost beds of the series, however, we became aware of the fact, from the evidence of its fossil fauna and flora, of the gradual freshening of the water. This is particularly shown in the Purbeck Beds at the summit of the series, where submerged forests, trunks of trees, shoots and roots, fossil cones of palms, etc., are of such frequent occurrence. Lying above these limestones of the Purbeck age we find the Wealden series consisting of a vast accumulation of highly coloured sands with inter-

vening clays, piled one above the other, and covering a large area, yet only seldom fossiliferous and consequently giving little record of its origin, except in particular zones, where comparatively thin bands of high interest yield remains of plants, leaves, and fruits of trees, and so on, giving evidence of their deposition at the mouth or estuary of some large river draining a continent lying away towards the north-west. Above these Wealden beds again, over the largest part of England where sections of the formation are found to occur, lies a series of sands, gravels, and clays, which are known as the Lower Greensand, Gault, and Upper Greensand, of which the Lower Greensand is of varying character lithologically in different parts of England. These, however, all agree in their evidence of their having been deposited under salt water. The Greensands and Gault Clay—Neocomicans as they are called—are themselves succeeded by the great formation of the chalk, which required an oceanic area for its deposition. Briefly recapitulating these we have as follows :—

Oolites proper, showing marine conditions.

Purbeck .. fluvio marine.

Wealden .. estuarine.

Neocomicans .. marine.

Chalk .. marine.

Within the narrow limits of Punfield Cove, however, we find the connecting link, which we were in search of, giving evidence of the transition from the estuarine conditions of the Wealden to the purely marine conditions of the Neoconians, just in the same manner as the Purbeck beds give indications by their fossil remains of the incoming of fresh water after the long period of salt water conditions under which the various beds of the Great Oolitic series were being laid down.

It would be well to briefly examine the character of this interesting little group of beds, which conveniently fill up this important gap in the geological series. We shall find the best description of them in Professor Judd's paper in the *Quarterly*

Journal of the Geological Society for 1871, where he notes the difficulty of accurately working out the sections on account of the quantity of debris and material resulting from minor landslips during rainy weather, which cover the ground and render a survey of the whole series very difficult. Mr. Judd estimates these beds of an aggregate thickness of perhaps 200 feet, and he divides them into three series, as follows, passing from above downwards:—

1st. Dark blue slates, in part cypridiferous with intercalated thin bands of limestone, containing *Cyrena*, *ostrea*, etc., and fibrous carbonate of lime, resembling the beef of the Beef Beds of the Purbeck series.

2nd. A series of feruginous sands with bands of clay and some lignite, much resembling the Bagshot sands in lithological character. Several bands of ferugineo-calcareous rock occur almost composed of oyster shells—often known as Oyster Beds, and emitting a foetid odour when struck. The fossils are mostly marine. Mr. Judd found the oysters themselves to be almost entirely dwarf forms of either *exogyra*, *sinuata*, or *Bousingaulti*.

3rd. The marine band, which, though only twenty-one inches thick, is of the greatest interest from its fossil contents representing a very considerable marine fauna, and hence offering itself for comparison with the fresh water Wealden below. The chief fossils are Ammonites, *Vicarya*, *Cerithium*, *Trochus*, *Natica*, *Cardium*, and many other molluscs, together with teeth of fish.

This brief description of the three groups of beds occurring in Punfield Cove is a resume of Professor Judd's own words in the paper above mentioned. On taking a survey of our position we recognise the fact that lying above the series of variegated sands and clays of the Wealden series, which are of fresh water origin, and from which freshwater and terrestrial forms of life have only been obtained, attaining a thickness of upwards of 2,000

feet, as they do here in Swanage Bay, we suddenly are confronted with this extremely thin band, insignificant as far as its thickness of 21 inches can make it, yet revealing the fact of an entire change in the physical condition of the surrounding neighbourhood in the remains of such genera of molluscs enclosed within it, as *Ammonites*, *Trochus*, *Cerithium*, and *Natica*, which are of marine character, and the last three of which we may find to-day in the English Channel. The over-lying beds of the two former divisions point to that fluctuation of salt water and fresh or brackish water alternately occurring on an area of deposition, which we should expect to witness in a locality where the land was sinking relatively to the ocean, but still sinking gradually ; and which we find to be borne out by actual observation over such areas at the present day where this process is being carried out. The oyster beds of these series are extremely difficult to examine *in situ* owing to the rubbish fallen from the cliff above having obliterated the sections. Still in the fragments which may be found lying strewn about we are able to gain some knowledge of their character. They appear to consist of the nature of a sandy ironstone, the bedding planes being covered with accumulations of oysters. These oysters, which are of two species, are marine in character, and are apparently dwarfed and stunted in size, as though they had lived under conditions unfavorable for their development, such as we should expect in areas where the sea was gaining relatively to the land, and where salt water and brackish water conditions would prevail alternately.

At Warbarrow Bay, lying to the East of Lulworth Cove, Professor Judd was able to obtain a section of the Punfield Beds, though in this latter instance they were greatly attenuated, having a thickness not exceeding 70 feet. In the Isle of Wight the equivalents of the Punfield beds have been traced in those sections in the Southern portion of the island, where the Wealden and overlying beds occur as at Sandown and Brixton. At this latter spot the thickness is approximately about 250 feet. In the Wealden area of Kent and Sussex the occurrence and character

of these beds is difficult to establish owing to the imperfection of the sections.

On passing from our own Island to the Continent we find that the most important equivalents of the Punfield beds are to be found in the Spanish peninsula, and these are of especial interest from their containing large deposits of coal. So important indeed are these that they are estimated as capable of supplying the whole country of Spain for a period of 200 years. They occur principally within the boundaries of the old Kingdoms of Aragon and Valencia, with minor coalfields at the mouth of the river Ebro. It is interesting to reflect for the moment on passing on the difference in physical conditions which must have occurred during the same epoch of the earth's history, and within so comparatively small an area as that contained within the limits of Southern Spain and these southern counties of England, to allow so large an accumulation of coal-bearing strata, and of great economic value, in the south, while these beds of sand and thin clays intercalated of Swanage and the Isle of Wight were being deposited along the northern limits.

The speculations on the physical conditions existing over particular areas of the earth's surface, and the relative distribution of land and water during special epochs of the past, are among the most instructive of any that Geological science has to teach, and possess a special attraction for some observers. Before bringing this short sketch of the Punfield Beds to a conclusion, it might make our subject more complete if we were to take a glance at the views which have been advanced on this side of the question. Professor Ramsay, in his book on the Physical Geography and Geology of the British Islands, has written at length on the matter. He shows that the character and organic remains of the Wealden series point to their deposition in the estuary or near the mouth of some large river. The area occupied by their deposits, extending as they do into France, might

be estimated to have been about 300 miles in length by some 200 miles in breadth. From this we might assume a river delta of an extent of not less than 20,000 square miles—though from various traces we may reasonably infer that the influence of denudation has obliterated much of these original deposits which formerly extended far beyond their present limits. Professor Ramsay quotes the delta formed by the united rivers, the Ganges and the Brahmapootra, which is usually estimated at not less than 40,000 square miles, and the delta of the Quorra in Africa estimated at 25,000 square miles. From such facts as these we may infer that the river, which brought down the material out of which the great formation of the Wealden was built up, was one ranking amongst the first in magnitude. Professor Ramsay's picture of the character of the old continent through which this river flowed is so graphic I trust I may be excused for reproducing it. He says towards the west lay the granite hills of Devonshire separated by a broad valley from the mountains of Wales. The old Mendip hills, which as hills were much older than the Oolitic Series, then lay buried deep beneath the Oolitic strata, and the ground between Wales and the North of England formed part of the plain bordering the river. Far away to the north rose majestic mountains, which we now call the Highlands of Scotland, much higher then than now, since they have been undergoing unceasing change and disintegration. We have probably no knowledge of the mountain vegetation, but on the flats by the river, were Equisetums and ferns, Coniferous trees, Zamias and Cycas, on drier ground, with marsupial animals, crocodiles, turtles, fish, the Iguanodon, the gigantic Megalosaurus, and Hylaeosaurus, whilst the winged Pterodactyl preyed on insects that flitted through the air, probably as warm as that of the delta of the Ganges.

Such, geology teaches us, was the character of this neighbourhood during the epoch of the Wealden formation ; it was at the close of this epoch that the change was brought about which occasioned the deposition of the Funfield beds, which have

formed the subject of this paper, which, though of so small a development as we have already noticed, are of special interest to us from their association with Dorsetshire.





Bindon Abbey and Woolbridge.

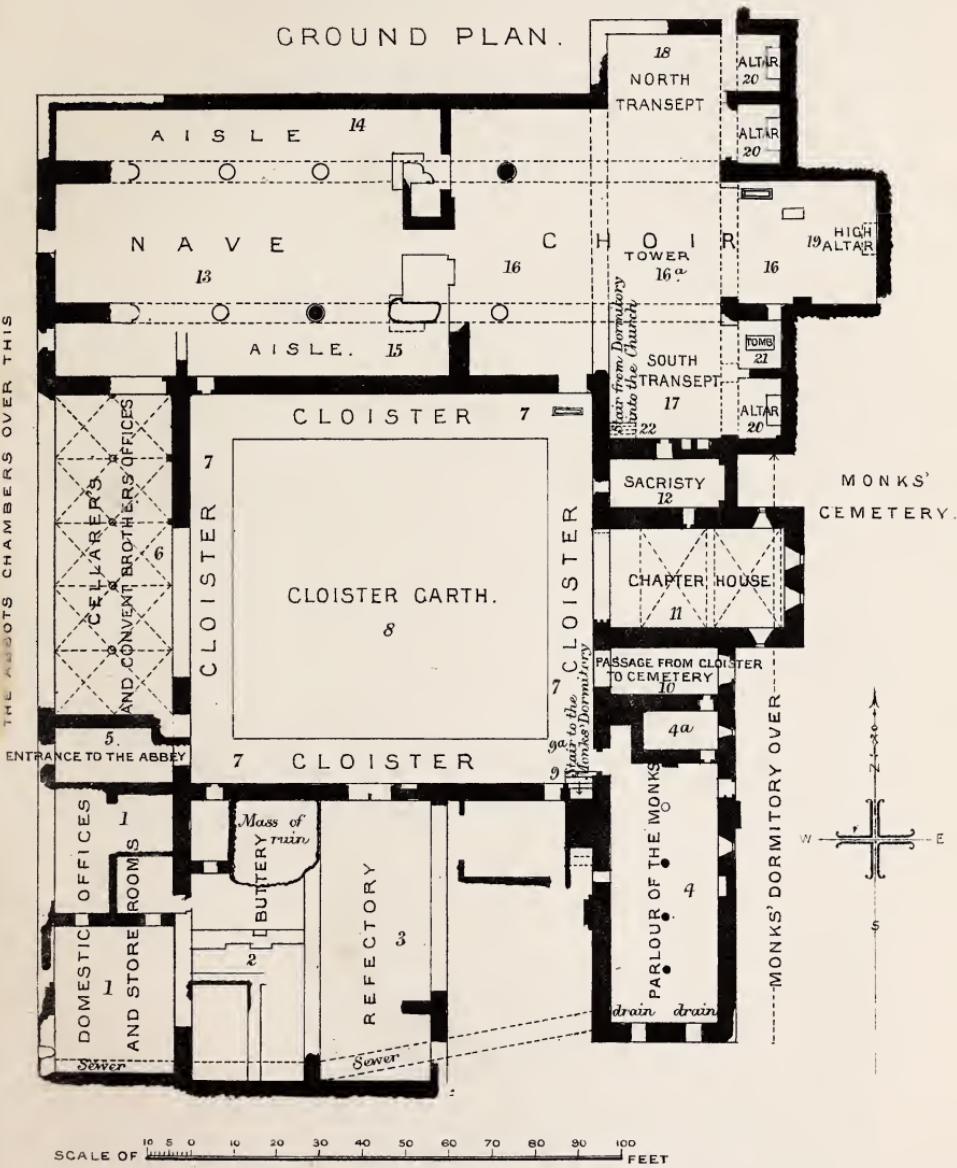
By H. J. MOULE, M.A.



T. Mary's Abbey of Bindon was of the Cistercian Rule.

I don't know whether or not I am speaking to any members of the Roman Church. However that may be, God forbid that I should say a word that could be called a harsh word about anything connected with that Church—above all not here, where we stand by the courtesy of a great Roman Catholic family. Rather would I remind you of the unwearying struggle after holiness which the story of monasticism displays. Rule after rule failed, rule after rule was invented, each to be the panacea for the faults and failures of those going before. St. Benedict of Nursia, in 529, founded the great Benedictine Order with stricter rules than prevailed in the old, somewhat vaguely regulated communities of monks. The Benedictine Rule, as ages went by, developed such worldliness that at least three puritan schisms from it took place. These resulted, in the course of the 11th century, in the establishment of the three new orders. There were the Carthusian and the Cluniac. But the third, as far as mediæval times are concerned, clung best to the original foundation rules, it seems. This order was founded in 1098 by an

THE CISTERCIAN ABBEY
OF
BINDON, DORSETSHIRE.
GROUND PLAN.





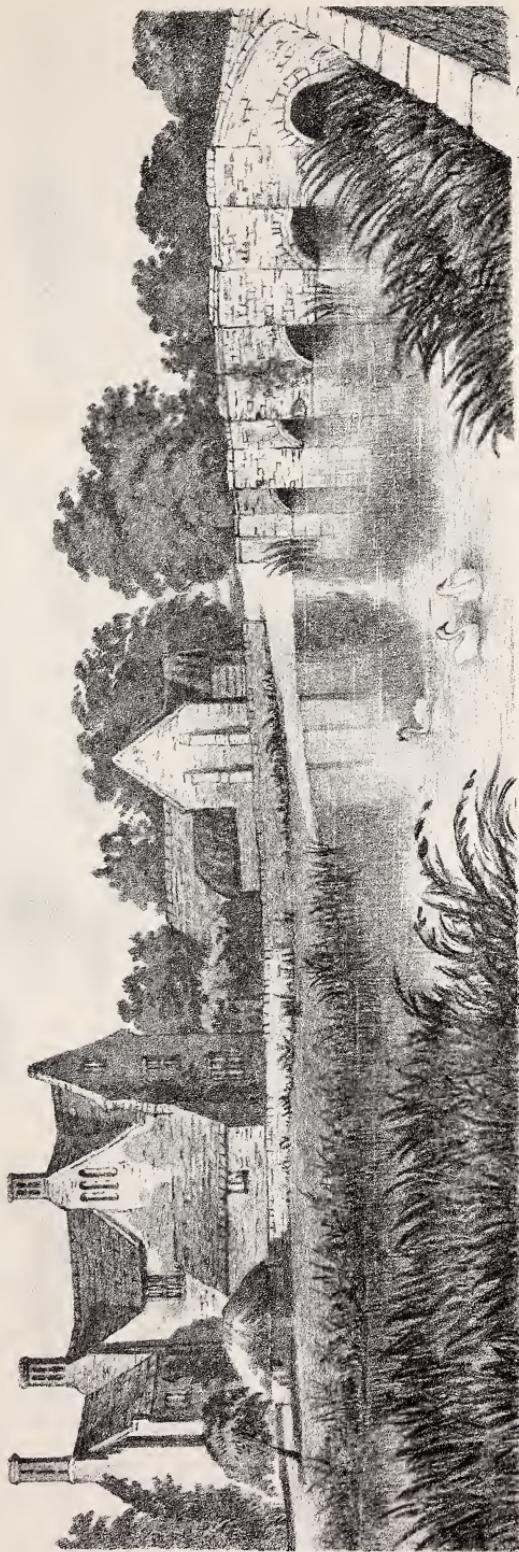
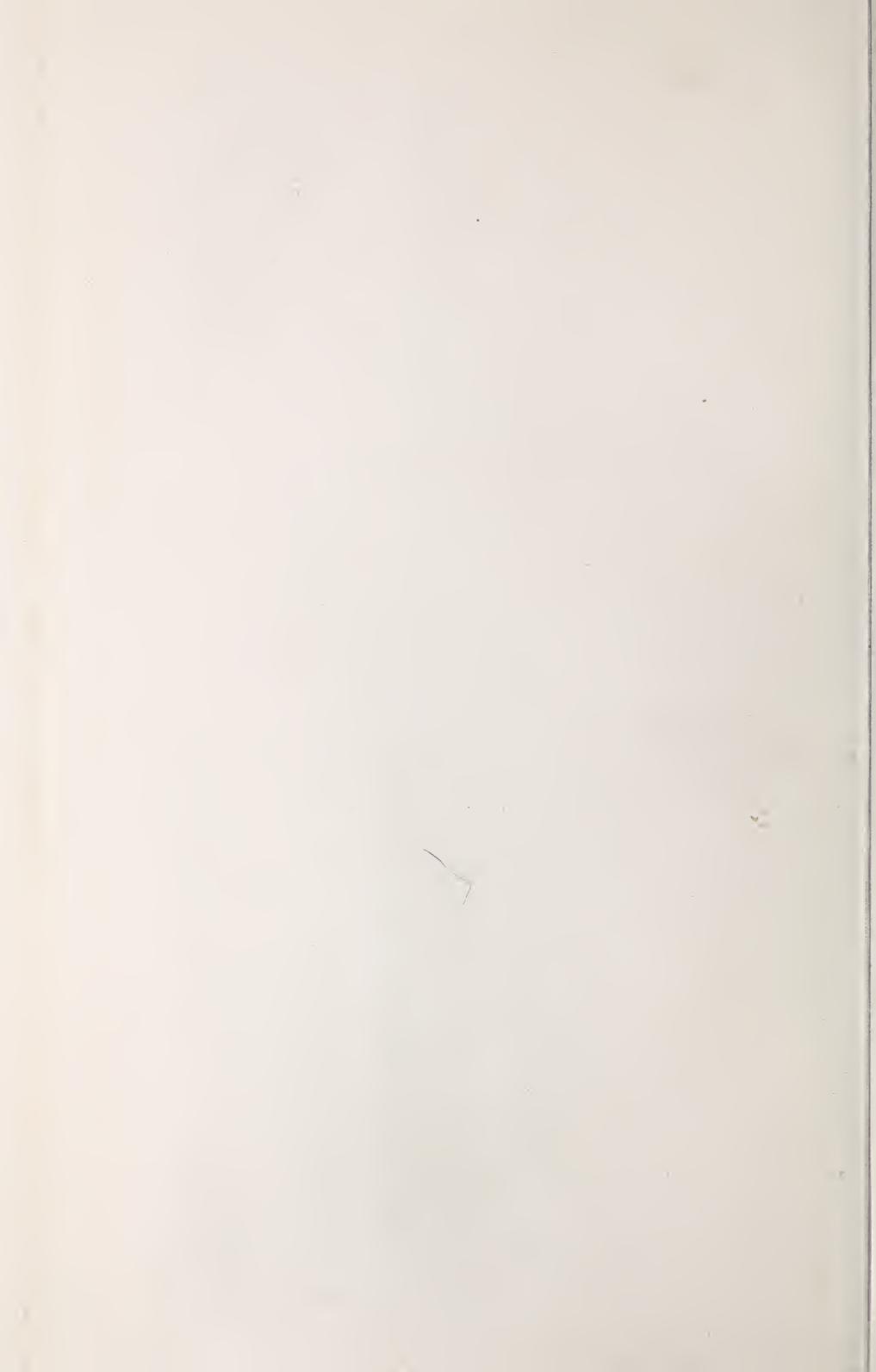
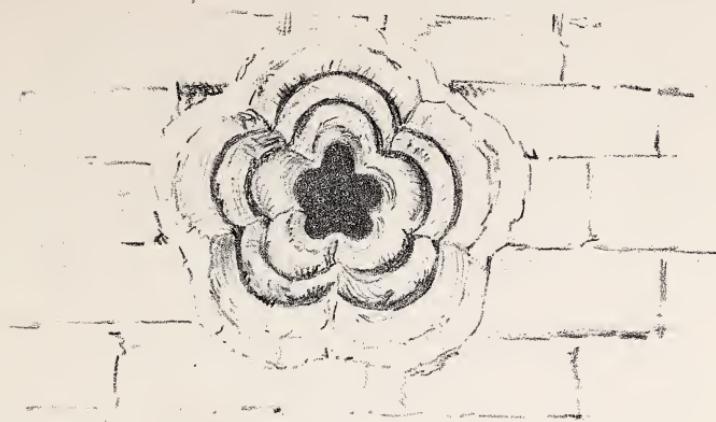


Fig. 16, 1860, 38.

WOOL MANOR, HOUSE, CHAPEL & BRIDGE.

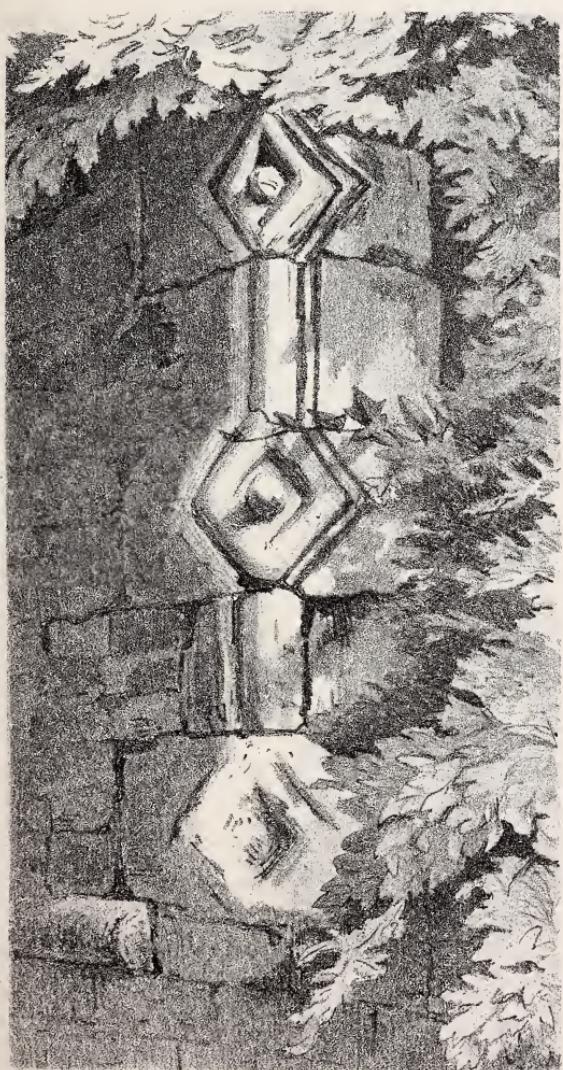
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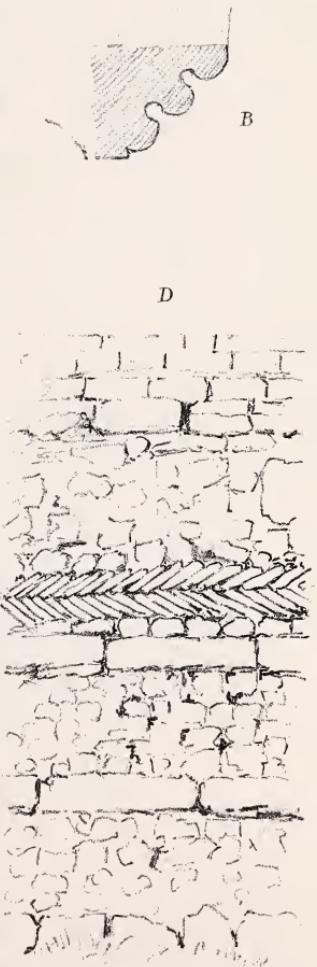


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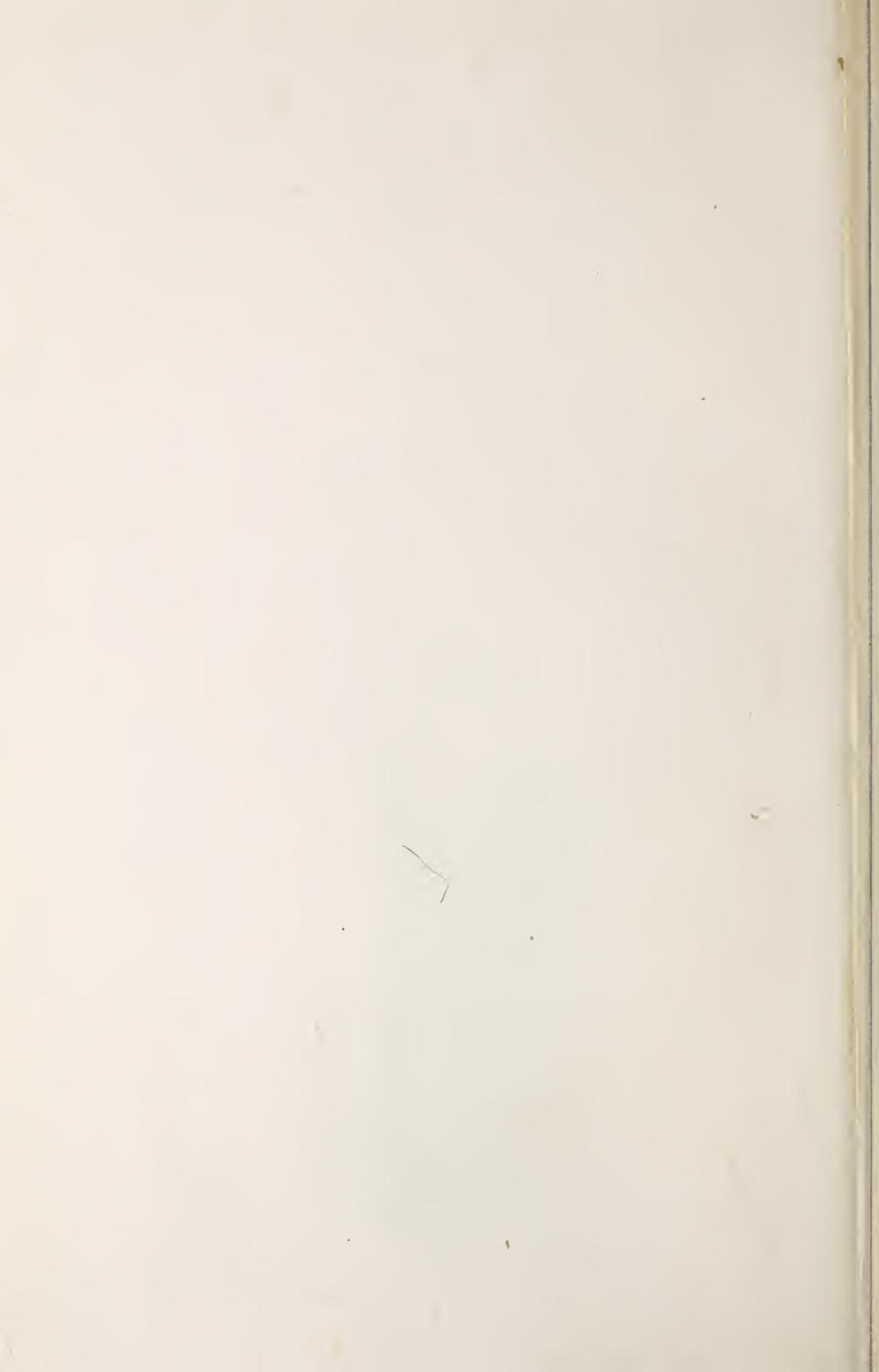
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H. J. Moule del.

Architectural details from (C) Chapter House, Bindon Abbey, and
(A.B.D) Chapel at Wool Manor House.

Mintern Bros. imp.



Englishman, Robert, Abbot of Benedictine Molesme, in the diocese of Macon, Burgundy. He and others, disgusted with Benedictine laxity, seem to have thrown up position and wealth. They retired to a meadow secluded in the midst of the forest of Citeaux, fourteen miles north-east of Beaune, also in Burgundy. Citeaux, Latinized into Cistercium, gave the name to the new order, one principle of which was an obligation to manual labour. It was in other things a hard rule which the Cistercians followed, or meant to follow. For instance, they allowed scarcely any fires in their monasteries, how cold soever might be the season—they might not talk together except for a short given time once a day—they denied themselves the glories of architecture. What a denial this last! I don't suppose we can realise what it was. In those ages when not a few men could design such noble work as Corfe Keep and Romsey Nave, it seems reasonable to believe that multitudes could fully enjoy the same. We can't do the first, and perhaps can only half do the second. It must have been hard—with the Benedictine splendours of grouped towers, and rich detail, and glowing glass even then coming in, and gorgeous hangings, and flash of jewelled altar and altar plate, and far heard sound of bells—it must have been hard to say "We will have none of these things." But the Cistercians said it, and were as good as their word for a long time and in most instances. I have run on about this matter because this old reaction against the pomps and vanities of the world, creeping in under colour of glory to God, is of the deepest interest. And here we stand on the site of what a good authority says was one of the completest English Cistercian houses. It is a moving thought that here at Bindon our Dorset forerunners of old set themselves hard to work to serve God and to rule others into serving Him. It is a thought full of sad pathos that their hard work failed. "Stone walls do not a prison make." You cannot wall in the free heart. You cannot wall out the world. But, as I say, the place where the effort was made is no common ground.

It is a terrible loss that for generations the Abbey was the quarry of the neighbourhood. One would dearly like to have seen the church and house, even if ruined, yet in some dignity of ruin, instead of the present almost annihilation. Even the foundations are hard to make out. By the kind cleverness of one of the lady members of the Weymouth Field Club you have copies of the plan in Hutchins. This to some degree helps us to understand the building, and still more the ponds, or moats. I now show to you a plan enlarged from one in the "British Archaeological Society's Journal" for 1872. In this year the Association visited Bindon, and Mr. Gordon Hills read a capital paper on the Abbey. This and the plan have been most courteously lent to me by a leading member of the Dorset Field Club, and have been of great service. In this plan we see one or two parts of the building named not in accord with tradition. These I will point out; and in passing let me draw your attention to the good arrangement of the buildings, all the minor parts of which lie south of the church, so as not to be overshadowed by its lofty mass.

To proceed to the plan :—*

1, 1.—DOMESTIC OFFICES AND STORE ROOMS. Here, at the outset, Tradition says No. The room in the angle is traditionally said to have been the guest room. In this room at 1 p.m. every day dinner was laid. The Abbey bell rung, and all and sundry were welcome to come and eat and drink. Mr. Langford, guardian of the Abbey, tells me this tradition about the bell, and it is also to be found in the last edition of Hutchins, on the authority of the Rev. Walter Kendall.

2.—THE BUTTERY.

3.—THE REFECTIONERY. Here again the plan differs from tradition, as I shall mention immediately.

4.—THE MONKS' PARLOUR, OR TALKING ROOM. In the Cis-

* This plan is reproduced by the courteous kindness of the authorities of the British Archaeological Association.

tercian rule talking was forbidden except for a given time (as we said just now), and the parlour was their place of assembly for their daily chat. But tradition hath it that this room was the Refectory, not No. 3. And certainly, if the parlour, we can hardly understand why the drain of the monastery started from it, as it did. Whereas if it was the refectory the drain was in place. For I believe dish washing was done *in situ* in old times. Whether Refectory or Parlour this must have been a fine room, 60ft. x 22ft., and vaulted over from each wall to four piers down the centre. Three bases remain. The recess by the door into the cloister is said to have been for the reader's pulpit or desk.

4a.—Not specified in the plan ; is said to have been the penitential cell. It must have aggravated the punishment for the penitent to be within earshot of either the talk of the parlour or the trencher-business of the refectory. The one very small window has the sockets for a strong bar.

5.—ENTRANCE TO THE ABBEY—down two or three steps by the door. The entrance to the Abbey precincts was through a gatehouse, with archway high enough for a load of hay to pass under.

6.—CELLARER'S AND CONVENT BROTHERS' OFFICES, WITH THE ABBOT'S DWELLING ABOVE.—From his windows he could, as it has been pointed out to me, watch the comportment of the monks during at least part of their walk in the cloisters, over the roof of which he could doubtless look. I take it for certain that he had stairs from his dwelling into the south aisle of the church.

7, 7, 7, 7.—CLOISTER.

8.—CLOISTER GARTH. Not a few broken stone balusters are to be seen among the ruins. It is said that these are remnants of a balustrade which filled the intercolumniations of the cloister. The greater part of the balustrade and all the cloister pavement were removed to decorate and pave the terrace which in part surrounds Lulworth Castle.

9.—STAIRCASE FROM THE CLOISTER TO THE MONKS' DORMITORY OVER 4, &c.

9a.—Not specified in the plan. Here is a broken bracket on which an image of St. Mary is said to have stood. Before this the monks said a prayer on descending the stairs. Close by on the ground is a gravestone. Under this each abbot was laid at his death, to receive (as I understand it) the benefit of those prayers until the death of his successor, whose corpse then was laid under the stone, the bones of the former abbot being then finally interred in the church.

10.—PASSAGE FROM CLOISTER TO CEMETERY. This Tradition denies, affirming that the graveyard was north of the church, where several interments were found almost within living memory. The tradition of the place is all in favour of the ponds being of monastic times, and affirms that the square enclosed within the principal moat or pond was not the graveyard, but the kitchen garden. Further it says that in the middle was a mound, now more or less altered by brick work of the last century. On this mound was a Calvary, forming the last of the stations of the Cross, of the Abbey.

11.—CHAPTER HOUSE. This must have been a quaint but strikingly noble room. It is about 40ft. \times 22ft. If you examine the remains of the vaulting springers you will see that for thirty feet of the length, the part marked with diagonal lines, the vaulted roof rose at the loftiest pitch—a triumph of the very earliest pointed style it seems to me it must have been in design and detail. Then over the last ten feet of the length, to the west, a low plain barrel vault was carried. The same was done in

12, which was the SACRISTY, opening into both Chapter house and church. I shall show the reason of this low vaulting presently.

13.—NAVR OF THE CHURCH. Engravings exist of the north arcade, of which now only one base remains.

14, 15—SOUTH AND NORTH AISLES.

16, 16a, 16.—**CHOIR.** It is to be noted that the Cistercians liked long naves and small, simple choirs; and here, as far as stone work is concerned, is one example. But you see the ritual choir was run two bays down the nave, in the same way as at Westminster, and as is very usual in Spain.

16a.—The plan says that here was the tower between the transepts—in the cross aisle as the old parlance was. The tradition is against this, asserting that the high walling remaining at the West end is the remnant of the tower. I confess that it hardly looks like it to my eyes, yet local traditions on a point like this should carry great weight.

17, 18.—**SOUTH AND NORTH TRANSEPTS.**

19, 20, 20.—**ALTARS.**

21.—**TOMB OF THE FIRST ABBOT, ROBERT DE MANNERS.**

22.—**STAIR FROM THE DORMITORY INTO THE CHURCH.** This descent was the reason for the low vault over the Sacristy (12) and the west end of the Chapter House (11.) Over these low vaults ran the passage from the dormitory, which extended over 4 and 10, but certainly not over the high glorious vault of the chief portion of the Chapter House (11) as asserted in the plan. Just think in passing of the striking appearance of that Chapter house, and conjecture the arrangement of the west end and picture the monks in their white habits and black hoods and scapulars, sitting in conclave amid its light and shade. But I must not dwell on this.

Mr. Hills points out that there were set forms of ground plan for the different Orders in their Convents as is well known. And he says that this convent here was a remarkably good typical Cistercian house in plan, even considering that of the same rule were Tintern and Fountains.

I may name in passing a Carthusian peculiarity.

In their houses there was, east of the church, and connected with the ordinary cloister, a far larger one, round which were the monks' cells. Each cell has the monk's little garden in front, and in the midst of this belt of men's gardens is God's

Acre, the graveyard. But as to Cistercian Bindon, on almost all points except the details above-named, I defer to Mr. Hills' evident learning. I cannot, however, quite go with him in thinking Cistercian strictness was maintained here to the last. Lübke speaks very clearly of that strictness extending to plainness of church style, and in particular to abjuring all towers or spires, other than one small central bell cote. Now I admit that as far as can be judged from your view of the north arcade of the nave here, remaining in 1733, the absence of vaulting shafts seems to prove also the absence of a vaulted roof. But the remnants of detail in the Chapter house are of captivating beauty I humbly conceive. And we can hardly imagine that the Church was destitute of the like. And there is another point. All men have heard church bells, but not all men have seen a ring of bells going. The noise is great, but 'tis well worth while to brave that for the weird attraction of the sight, especially at night, with a light just enough to make darkness and the massive cage and the rushing bells visible. On New Years' Eves I have watched the peal of Fordington St. George. Legend after legend, new and old, shows up as it rises into the candle light and vanishes into the black shadows. But what are those two Gothic ones that gleam up so fair among the 18th and 19th century lettering? *Sancta Katarina ora pro nobis. In multis annis resones companna Johannis.* What of these? Well, these are Bindon bells. These, there is little doubt, were baptized here in Bindon nave. These, with no less than 10 more, are said to have formed the Bindon peal. Considering that the original Cistercian rule forbade anything above the Church other than a central bell cote, it seems hardly in form to have had a 12 bell ring in a western tower. Tradition dies hard. Here at Wool and elsewhere the carrying off of the bells is still spoken of in the doggerel

“Wool streams and Coombe Keynes wells,
Fordington rogues stole Bindon bells,”
and a lane here, done away with only of late years, was always

called Bell Drong, and said to be the place where the bells were hidden, to be carted away by night.

We all know that every mediæval English monastery has undergone two processes—foundation and dissolution. But Bindon was a very much founded and dissolved Abbey. It was founded 3 times and dissolved twice.

It was first founded by Gul. de Glastoniâ at Little Bindon, West Lulworth, where an interesting but rather later little chapel remains.

Then owing, it is supposed, to the windswept situation of this place, the monastery was re-founded in its present site by W. de Newburgh in 1172. In 1536, by Act of Parliament, all monasteries of less clear yearly value than £200 were dissolved and made over to the king. In this category was Bindon; although, to read the list of the Abbey possessions, it is hard to see how, even then, the value can have been so small. Anyhow this was dissolution No. 1. Then, next year, King Henry VIII. actually refounded the monastery—the third foundation. Two years later it fell again, finally, with all the rest in the realm. The brotherhood was small. At one time, at least, there were but 9 Monks. However, the Abbots sat in Parliament.

I cannot but draw attention to the extreme contrast of character in the later as compared with the older site. The first—high, treeless, waterless, swept by the sea winds; the second—in the very alluvium of the Frome, with woods around as named in charters. This leads us to mention the remarkable series of moat-like ponds. From what I can gather from Hutchins and tradition they are relics of monastery times; although Mr. Hills thought them unworthy of much attention, and, therefore, presumably, he considered them modern. I cannot conceive why. An Abbey by the watercourses, like Bindon, was absolutely certain to have a series of fish-ponds, and though they

would get out of order and partly fill with mud, they would not disappear. On the other hand one does not see by whom they were likely to be made here in later times. As to monastic times, we do not perhaps always reflect how all but an absolute necessity fish ponds were to a convent, and especially to one belonging to the strict Cistercians. I suppose that on fully 100 days out of the 365 fish formed their only animal food! With such facilities as the Bindon site afforded, it seems to me that the series of ponds shown in the plan which you have is just what would have been likely to be made, and too elaborate for later requirements, if any.

I have now given you the slight sketchy jottings about Bindon, which divers occupations and hindrances have hardly allowed me to gather from Hutchins, Coker, Hills, and last, not least, from the Rev. Walter Kendall and from Mr. Langford, here dwelling.

I will conclude by a very brief word about three other neighbouring old buildings. I do not here mean Wool Church as one of them, although worth examination and containing a piece of mediæval embroidery. I am thinking, first, of the two interesting old bridges, Holme Bridge below and Wool Bridge above Bindon.

I cannot give the dates of these bridges with any certainty; but I set them down as built early in the 16th century. Wool Bridge, I take it, was pretty old in 1607, for it then needed repairs as I find in the Municipal Records of Weymouth (see page 137 of the Catalogue thereof). It is a charmingly picturesque bridge, when you get right light and shade, which I fear you will not do at this time of day. Long may it last, road locomotives notwithstanding.

Building No. 3 stands close by the bridge, grouping well with it. It is Wool-bridge House, a good and delightful specimen of Jacobean date, I think. In the barn gable by the roadside

is a curious stone, with a deeply moulded cinque-foil piercing of first or early second pointed date. A few years ago it stood in a most picturesque gable, since rebuilt, but with the stone and some of the timbers retained. In the house there is a good specimen of the old wooden door bar, sliding into a cavity in the wall. I wind up by telling the company that Woolbridge House was a seat of the Turbervilles, an old Dorset family whose headquarters were at Bere Regis. What episode in their history accounts for the apparition I know not; but 'tis said that a spectre coach-and-four drives out from Woolbridge House in the gloom of evening—The Turberville coach. Now none can see the ghostly coach of the Turbervilles but those who have Turberville blood in their veins. What a very flat ghost story you will say. Very likely. I leave it on its merits. I have no note or comment to make. But one thing more I leave for consideration—a fact. A gentleman whom I have the honor to know was passing near here one evening of late years—going to dine with friends. On arriving he asked which of their neighbours kept a four-in-hand. No one. Yes, he said, some one must, for I've just seen a four-in-hand—a queer, old-fashioned, but handsome affair, with outriders. No, they said, no one here keeps such a turn-out, but—you've surely seen the Turberville coach. Now he is akin to the old Turberville race.

NOTE.—It was a defect in the above paper that in it attention was not drawn to the very interesting masonry of the north wall of the barn at Woolbridge Farm-house. A slight elevation of it is now given. It will be seen that 6 feet in height of this wall is curiously banded with several varieties of masonry, one band being “herringbone.” Now it is rash to call every “herringbone” wall Saxon. Still the impression produced by examination of this masonry here is that it is older than the coigns and the connected east and west walls. Now these last seem to be of early 14th or perhaps of 13th century architecture. For this bit of wall to be carefully pre-

served by the builders of that period it must have had some charm in their eyes. And the charm of antiquity would be the most likely to influence them. Assuming this we may admit the probability of the curious masonry in question being Saxon. We may remind our readers of the apparently careful preservation by the 13th century builders of the Saxon "herring-bone" work in Corfe Castle. If this wall at Wool-bridge is Saxon it is of course much older than the Abbey. Nevertheless the tradition that it belonged to the Abbey, and was a chapel, is likely enough. A chapel connected with, or even on, a bridge was common. Some on bridges remain, as at Rotherham. Many of our readers must have seen the pretty, but over-restored one on the The Rhine-bridge at Basel. If the Wool-bridge barn was of old a chapel it was of uncommon plan, unless we are mistaken. It looks as if the ante-chapel was placed across the choir, as at Eton. It is difficult to say what the original use or position of the cinquefoil'd stone in the east gable was. Just possibly it may have grouped with and over two lancets.

At the meeting on June 3rd it was well said by Mr. T. B. Groves that doubtless the name Bindon was imported from Lulworth Bindon, *don'* being 'down,' which does not exist at the Wool Bindon. Mr. Groves asked what is the meaning of 'Bin.' The Rev. W. Barnes informs us that it is the Saxon 'binnan' 'within.' Lulworth Bindon is within the Down, and Bincombe is within the Combe, no doubt. Binnan seems to be made up of the prefix 'be' (as in our words between, beyond, &c.), and 'in.' Compare the Lowland 'But' and 'Ben,' the outer and inner rooms of a cottage.

Mr. Barnes further tells us that Bindon seems to have been well known in Italy in the 17th century. In 1664 the Grand Duke of Florence sent an ambassador to congratulate King Louis XIV. on his accession. The Ambassador kept a diary. This was published and illustrated with a map of North Italy

and France, which naturally included part of the English coast, Dorset appears on it. Now in Dorset there are but four names, Dorchester, Lyme Regis, Portland, and Bindon.

REFERENCES TO ARCHITECTURAL DETAILS.

PLATE III.

A.B.—Cinquefoil in Woolbridge Barn, with section.

C.—Cheek of window, Chapter House, Bindon.

D.—Masonry, Woolbridge Barn. (*a*) Modern brick. (*b*) Very rough rubble. (*c*) Herringbone. (*d*) One course of flints and other rubble. (*e*) One course of large stones. (*f*) Rubble, mostly flint. (*g*) One course of large stones. (*h*) Rubble. (*i*) Basement, of rather large stones.



The Amphitheatre at Dorchester.

By ALFRED POPE.



LTHOUGH so near Dorchester this grand earth-work stands in the parish of Fordington St. George, the ancient town of Dorchester not extending beyond its own walls nor comprising more than some 80 acres. It appears to have been the place of amusement and recreation of the Roman inhabitants of Durnovaria, and, like most other amphitheatres of its kind, was placed outside the city walls.

It is probably a work of the time of Agricola, who taught and encouraged the Britons to build temples, baths, and amphitheatres in order to introduce luxury and soften the fierce and rough tempers of that people. Judging from its size, it being capable of holding over 12,000 spectators, it was probably *the* place of entertainment of the people living in the various Roman stations established on the South Coast; hence it may be seen that our ancient town of Dorchester was a place of no small importance during the time of the Roman rule in Britain.

For the discovery of this work, as a monument of antiquity, we seem to have been indebted to Sir Christopher Wren, who in his frequent journeys to the island of Portland, whilst the cathedral church of St. Paul's was being built, was the first to notice it. Before its discovery by this famous architect it had always been called, as the common people call it now, "Mambury" or "Mamebury" Rings. Many etymologies of this word have been given. Hutchins says it may be from "Malm," or "Mame" (in the Dorsetshire dialect), a kind of earthy chalk, and "bury," taken in its common sense of an earthwork, as Poundbury, Woodbury, Cadbury, &c. Savage, in his little history of Dorchester published about the year 1830, says the word should be written "Maenbury," which is derived from the Celtic "maen," the same as the Latin "Lapis," a stone, and "barri," to divide, to separate, from its holding its spectators on both its sides. Mr. Warne, however, says it may be so called from a "great stone" which is said to have formerly stood at the entrance, but, being an obstacle to the cultivators of the land, was buried in a hole dug to receive it on the spot. A not uncommon pronunciation of the word amongst the old people of Fordington is "Mumury," which may very possibly be derived from "mummer," it being the place in which the local play actors or "mummers" are said to have carried on their "frolics" in former time. In May, 1879, on the occasion of a former visit of the Dorset Antiquarian Field Club to the county town, at which time I had the honor of being Mayor of the borough, an effort was made to find this stone, but without success. A trench some 8 to 10 feet deep was dug across the northern entrance from east to west, and another towards the centre of the arena, but no trace of it could be seen. A roadway some 5 or 6 feet wide and as deep, formed in the solid chalk, was discovered, and from more recent excavations on the site of the present Brewery premises this roadway seems to have taken a direct line to the southern entrance

of the town, the chalk at the bottom of the way being very much pressed and consolidated as if from the continual running over of wide wheels.

It may be seen that this ancient work is set on the top of a plain declining to the north or north-east, whereby the great heat of the sun would be modified during the greater part of the day. It is of solid chalk, upon a level with the ground, without any fosse around it. The jambs at the entrance are somewhat worn away, and the south or southwest half of the arena is some 6 or 7 feet below the original surface of the ground on that side; from which it may be gathered that a large portion of the chalk for forming the sides was dug out of the cavity in the centre. This centre portion has no doubt been considerably elevated by manuring and ploughing for many years past, and it will be observed that the sides have been ploughed down. Mr. Barnes says the arena was at one time, probably, circular, but has obtained its present shape from this continual ploughing, and that the original diameter of the work was 350 by 345 feet.

The receptacle for the gladiators and wild beasts, etc., is supposed to have been at the upper end, under the ascent to the Terrace, there being, it is supposed, vaults under that part of the body of the works. Mr. Warne, however, in his *Antient Dorset*, says he has been unable to discover any trace of such places.

Up to the year 1761 all the public executions took place here, and it will be observed that where the gallows formerly stood the terrace is somewhat injured by the trampling of men and horses. At the execution of the famous Mrs. Channing, for the murder of her husband, which took place in the year 1705, as many as 10,000 spectators are said to have been present, the top, sides and arena of the works being completely filled. According to Dr. Stukeley, this ampitheatre consists of an acre of ground and was originally about 140 feet in diameter the

shortest way and 220 feet the longest, thus being the largest in existence next to that at Verona and the Colosseum at Rome

These measurements do not agree with Mr. Barnes' measurements given above, but may be accounted for by Mr. Barnes having taken the external diameter and Dr. Stukeley those of the arena only. The external circumference would comprise about 2 acres, the ramparts being in some places 30 feet above the level of the arena. There do not appear to have been many coins or antiquities found in its immediate vicinity, a silver coin of the time of Phillip Augustus, A.D. 240, which got into the possession of a Mr. Pownall, of Lincoln, being the only coin of which I can find any trace; numerous coins were however found on the site of the present Brewery premises, which have been carefully noted by Mr. Moule, and may be seen in the County Museum, and during the excavation in 1879, to which I have before referred, some few bits of pottery, probably Samian and earlier Roman, were found, and a few bones and teeth of animals, probably red deer.





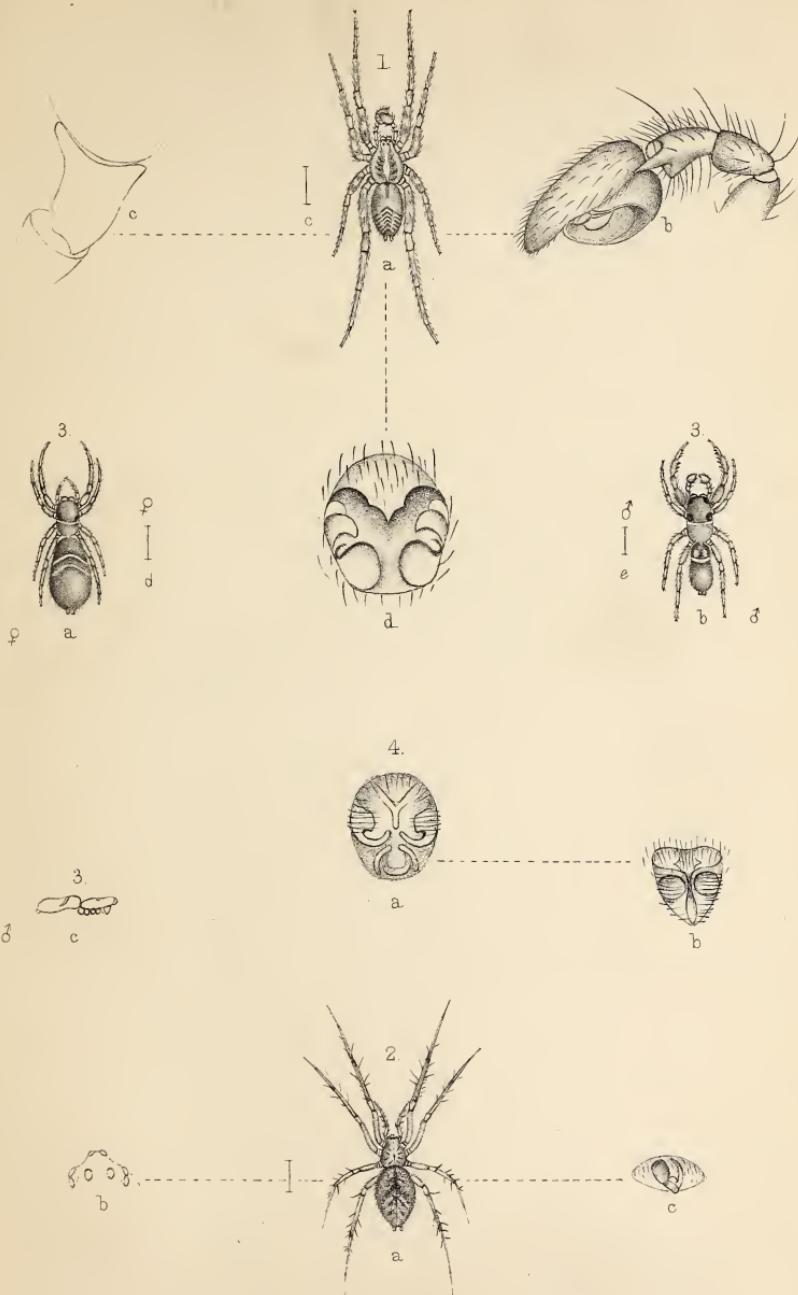
On Some New and Rare British Spiders.

By the Rev. O. P. CAMBRIDGE, M.A., &c.

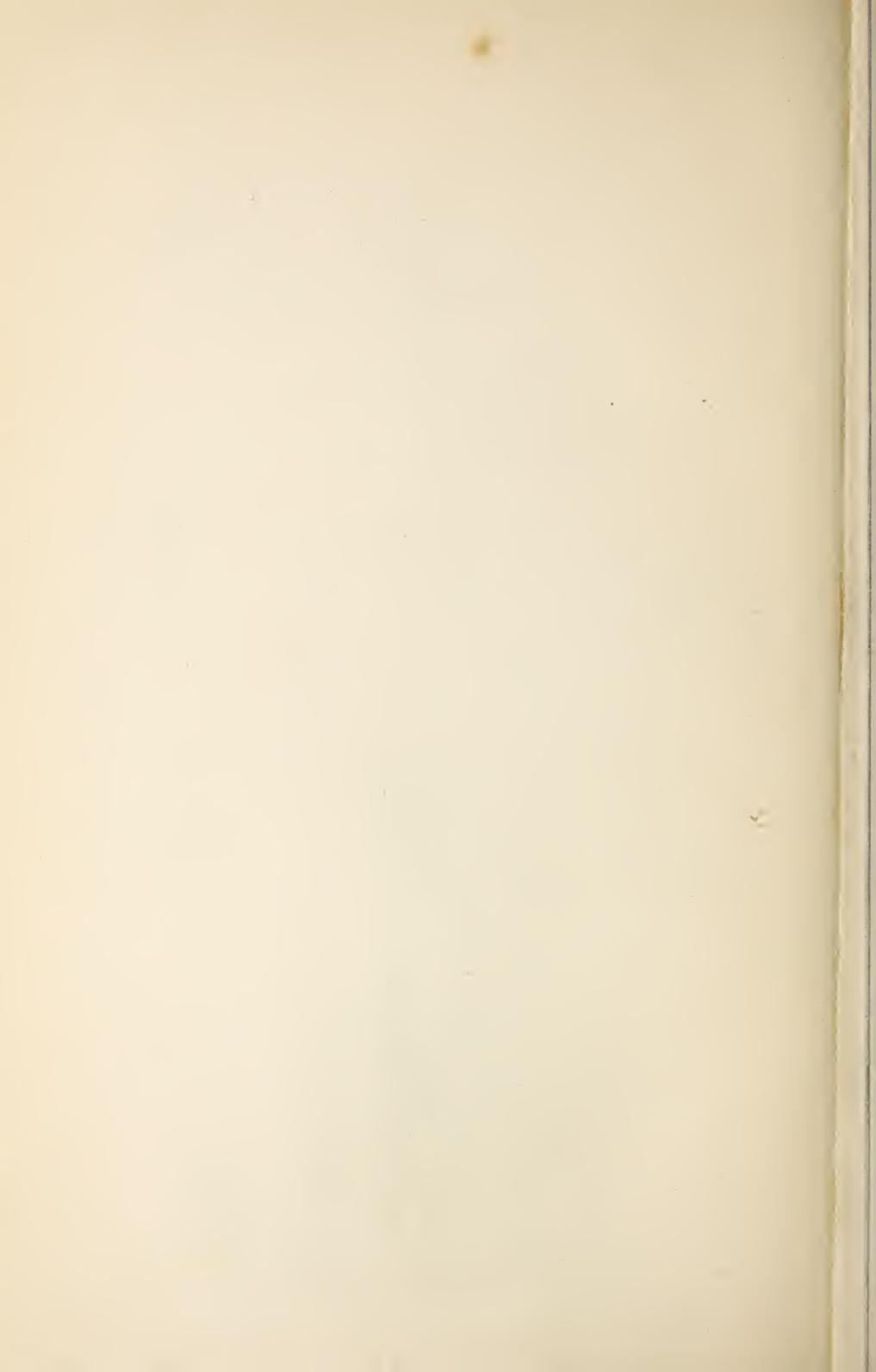
Pl. IV.



ANY circumstances have prevented my doing much work among spiders since my last communication to our Field Club in June, 1884. I have, however, to record the discovery of examples of a very fine and distinct new species of *Agroeca* at Lulworth in August, 1884. A description and figures of this spider are subjoined, together with figures of a critical portion of structure in two allied forms (*A. brunnea*, Bl., and *A. proxima*, Cambr.) from which its distinctness as a species may be at once determined. I have also found among numerous cabinet specimens, in my collection, of *Tmeticus (Linyphia) bicolor*, Bl., examples of a nearly allied but quite distinct spider, *T. concinna*, Thor. A detailed description of this spider is subjoined, and attention is called there to the characters by which



New and rare Spiders.



it may be distinguished from *T. bicolor*, Bl. I have also included here a short note upon *Linyphia subnigripes*, Cambr. (an Irish species), with figures of the adult female.

Since the above was written Mr. C. W. Dale has kindly given me an example of the young male of *Synageles venator* Luc., found by himself in the past summer at Charmouth. This ant-like Salticid is common near Paris and other parts of France, and I have also received it from Holland. Both the genus and species are new to Britain.

FAMILY DRASSIDÆ.

GENUS AGROECA, *Westr.*

AGROECA INOPINA, sp. nov., Pl. IV., fig. 1.

Adult male, length $2\frac{1}{2}$ to $2\frac{1}{2}$ lines. *Adult female* $2\frac{3}{4}$ to 3 lines.

In general form and appearance, this spider closely resembles *Agroëca proxima*, Cambr. It has, however, a generally duller brown hue and, when closely examined, the palpi of the male differ in the form of the radial apophysis and structure of the palpal organs, while the female differs notably in the form of the genital aperture. The legs also are perceptibly, though not very strongly annulated (the annulations being chiefly visible on the femora), while I have never detected any trace of annulation in *A. proxima*. It may also be distinguished from *Agroëca brunnea*, Bl., by the above characters, as well as by being much smaller.

Cephalothorax yellow-brown, narrowly margined with blackish and with a broad brown longitudinal band on each side of the median line. These bands are crossed by converging blackish lines corresponding with the junctions of the thoracic segments. The space between the bands is fairly well defined, and at its fore part are two longitudinal brown lines running backwards, one from each of the hind-central eyes.

The *eyes* are of nearly uniform size, seated on blackish spots, and rather closely grouped in two almost concentric curved rows,

the convexity of the curve directed backwards; the anterior row is the shortest and least curved; the height of the clypeus is less, or at most no more than the diameter of the central eyes. The interval between those of the hind-central pair is nearly about an eye's diameter and but very slightly, if at all, greater than that between each and the hind-lateral eye next to it, while in *A. proxima*, it is distinctly greater.

The *legs* are slightly paler than the cephalo-thorax, rather indistinctly, though unmistakably annulated with dusky brown. They are long, moderately strong, furnished with hairs, bristles and spines like the other closely allied species. Their relative length is 4, 1, 2, 3.

The *palpi* are similar to the legs in colour. The radial and cubital joints are nearly equal in length, the cubital being the stronger and slightly the shorter. The pointed apophysis at the extremity on the outer side of the radial joint is scarcely curved or bent at the point, and is closely adpressed to the base of the digital joint; this latter joint is large, oval, and comprises the palpal organs, which are well developed, rather prominent and complex. In *A. proxima* the radial apophysis is less strong, more curved, and prominent, while in *A. brunnea* it is longer, strongly curved at its point, and lies, like that of *A. inopina* close to the base of the digital joint.

The *falces* are similar to the cephalo-thorax in colour; in form and size they do not appear to differ from those of *A. proxima*.

The *maxillæ*, *labium*, and *sternum* do not differ in form and structure from those of *A. proxima*; their colour is similar to that of the legs, the *labium* being, however, suffused with dusky yellowish brown.

The *abdomen* is hairy and its ground colour is very nearly like that of the cephalo-thorax, a central blackish longitudinal line runs backwards a little way from the fore extremity of the upper side and is followed towards the spinners by a series of blackish angular lines or chevrons, the angles directed forwards (the angle of the

anterior one is broken) the sides are marked with oblique and other irregular blackish lines, spots, and markings. The under surface is occasionally marked with a few minute scattered blackish spots. The above pattern is similar to that found on most species of the genus, but in the present spider it is more strongly and distinctly defined than in *A. proxima* or *A. brunnea*. The characteristic form of the genital aperture of the female can only be understood from the magnified figure in the plate (fig. 1, d.); it is quite distinct from either of the other closely allied species just mentioned. (See fig. 4, a, b.)

The present species may be easily recognised from those others by an absence of their general brightish red-brown tinge of colouring, as well as by the other marks of difference above noted.

Examples of both sexes in the adult state were found by my son Arthur and myself on the 28th of August, 1884, among weeds and coarse dead herbage on the cliffs between Lulworth Cove and Durdle Door, where it appeared to be an abundant spider. Subsequently (October 22, 1884) I met with an adult female on Woolbarrow, Bloxworth, among heather.

This species does not as yet appear to have been met with on the Continent of Europe.

FAMILY LINYPHIIDÆ.

GENUS LINYPHIA, *Latr.*

LINYPHIA SUBNIGRIPES, (*Cambr.*), pl. IV., fig. 2.

„ „ „ *Id. Spid. Dors.*, p. 514).

As no figure of this distinct little species (of which the female alone has been yet discovered) has ever yet been published, I have thought it worth including in the plate accompanying this paper.

No lengthened description of it is needed here, as it is fully described in "Spiders of Dorset," appendix B., p. 514. It will suffice to note that its chief distinguishing characters are the prominence of the fore part of the caput where the fore-central

pair of eyes is seated, the black hue of the greater portion of the first and second pairs of legs, and the form of the genital process, all of which are delineated in the plate.

This spider was kindly sent to me from Belfast in the autumn of 1878 by Mr. T. Workman, and is allied to *L. luteola.*, Bl., (l.c., p. 194).

A new genus might perhaps be based on this species, but without the male before me I refrain from doing so. The more prominent position of the fore-central eyes distinguishes it from *Bolyphantes* Menge, to which it appears to be otherwise nearly allied.

GEN. TMETICUS Menge-Sim. (*Linyphis* Cambr. and *Thorell* ad partem.

TMETICUS CONCINNUS, Thor.

Linyphia concinna, Thor. Tijdschr., v. Entomol. xviii., p. 87., and K. S. V. Akad. Handl. xiii., No. 5.

Tmeticus concinnus Simon. Arachn. de France, v. Part 2, p. 402.

Adult male, length 1 line to $1\frac{1}{4}$, female a little longer.

The cephalo-thorax is of ordinary form, slightly constricted on the lateral margins at the caput, and has a distinct hollow in the profile at the thoracic junction, in fact at the point where the hind-slope begins it is a little prominent or gibbous. The height of the clypeus is distinctly less than half that of the facial space. Its colour is smoky yellow-brown distinctly margined with black and with some dusky blackish converging lines corresponding with the junctures of the thoracic segments, and there are several bristly hairs on the ocular area. The eyes are rather compactly grouped and of moderate size, seated on distinct black spots, the ocular area forming a transverse oval figure. Those of the hinder row are equally divided by rather less than an eye's diameter.

The legs are rather long, slender, 4, 1, 2, 3. They are of a paler hue than the cephalo-thorax, the tibiæ and metatarsi of the two anterior pairs strongly suffused with dark yellowish brown. They are furnished with a few very fine spines, chiefly

on the tibiæ, and, apparently, irregularly disposed.

The *palpi* are moderately long, cubital joint short with a single prominent tapering bristle at its fore extremity on the upper side; radial joint stronger and a little longer than the cubital, and furnished with a tuft of strong, straight, black bristles at its hinder extremity on the outer side, springing from a slight eminence and directed forwards. The digital joint has a strong obtuse prominence at its base; the palpal organs are prominent and complex, and have the characteristic curved corneous process at their base on the outer side, which in its varied form affords one of the best specific characters in spiders of this group.

The *falces* are rather long and moderately strong, slightly divergent towards their extremity, and similar in colour to the cephalo-thorax.

The *sternum* is dark-brown.

The *abdomen* is oval, and projects fairly over the base of the cephalo-thorax; it is of a shining, dull, blackish colour, sparingly clothed with fine hairs.

This spider is very closely allied to *Linyphia bicolor*, Bl., but may be distinguished by the larger size and closer grouping of the eyes, the less height of the clypeus, the distinct marginal black line round the cephalo-thorax as well as the converging dark lines on the thorax, and far more marked hollow in the profile of its upper margin. The legs also have the tibiæ of the two fore pairs more strongly suffused with brown, and the spines on the tibiæ of the first pair are far less numerous, as well as less strong, and not so symmetrically placed; those on the hinder tibiæ are also fewer. The spider itself is likewise smaller.

I have long possessed examples of this species mixed up with specimens of *L. bicolor*, and found on the heath and in woods in this district. I have always suspected their specific distinctness, but it is only recently that, on a close examination and

comparison, I have ascertained that they are the *L. concinna* Thor.

Mons. Eugène Simon having noticed chiefly the distinction afforded by the closer grouping of the eyes, conjectures that it may be only a rather more developed variety of *L. bicolor*. I feel but little doubt, however, of the distinctness of the species, having found the differential characters noted above constant in many examples. It is not only found in France, but in Germany, and I have lately received an example of both sexes from Holland.

FAMILY SALTICIDÆ.

GEN. SYNAGELES, Sim.

The Genus *Synageles* resembles *Salticus* in the antlike form of its species, but may be distinguished at once in the adult state, by the falces of the male which, instead of being greatly developed and projecting forwards to a length sometimes exceeding that of the caput, are short and vertical. The constriction also which divides the caput from the thoracic region is scarcely (or only slightly) marked in *Synageles*, whereas in *Salticus* it is very strong. The form also of the *labium* and *sternum* differs in these two genera.

SYNAGELES VENATOR, Luc. Pl. IV., fig. 3, a.b.c.

„ „ „ Luc.-Sim. Arachnides de France, tom. iii.,
p. 16.

Adult male length $1\frac{1}{2}$ line.

The *cephalo-thorax* is elongate-oval, truncated in front, and the ocular area is large, quadrangular, rather longer than broad, and when looked at from above equal in length to half that of the cephalo-thorax. It is somewhat flat, the division between the caput and thorax is marked by a transverse indentation rendered very plain by a stripe of white hairs. Its colour is dark brown, that of the ocular area black.

The *legs* are not very long, those of the first pair are much the strongest and darkest coloured: their colour is yellow-brown, with

an often very distinct longitudinal black stripe along the anterior side of, sometimes, all excepting the tarsal joints; they are furnished with hairs and a few spines beneath the tibiæ and metatarsi of the two anterior pairs, those on the first pair being much the strongest. Relative length, 4, 1, 2, 3.

The *palpi* are short, and of a yellow-brown colour, furnished with hairs. The radial is shorter than the digital joint and has a short, hooked or bent, pointed apophysis on its outer side. The digital joint is of fair size, and oval (in the immature and tumid state white or yellowish white). The palpal organs are large, simple, of an oval, or nearly round form, and do not appear to present any notable peculiarity of structure.

The *falces* are small, placed rather far back behind the anterior eyes, directed towards the sternum, and of a yellow-brown colour.

Maxillæ double the length of the *labium*, broad and slightly rounded at their extremities, which are much the broadest part.

Labium rounded at the apex, length and breadth about equal.

Sternum elongate-oval, breadth equal to nearly half its length, pointed behind, slightly hollow-truncate before. Its colour is dark yellow-brown, that of the *maxillæ* and *labium* being somewhat paler.

Abdomen elongate-oval, deep shining black-brown behind and reddish brown in front, somewhat cylindrical, with a more or less strong transverse constriction a little in advance of the middle, where it is marked with a transverse pale stripe, clothed with white hairs, encircling the sides and upper side; the extremities of this stripe are directed obliquely backwards. In some examples there is a pale diffused patch on the under side immediately behind the spiracular plates and genital orifice.

The *female* differs from the male, chiefly in the larger size of the abdomen.

An immature male, wanting only the final moult, and which I have no hesitation in determining to be of this species, was

found by Mr. C. W. Dale at Charmouth, in this county, in the summer of 1885. The above description is made from adult examples received from Holland. Both the genus and species of this very pretty and interesting spider are new to Britain. It is common in various parts of France, and even in the gardens of Paris, where M. Simon states that it is found on the trunks of trees, fences, and railings. In uncultivated open places, downs and wastes it is also found at the base of tufts of herbage.

DESCRIPTION OF PLATE IV.

Fig. 1.—*Agroëca inopina*, sp. nov.

- a. Full figure of male, magnified.
- b, c. Left palpus of male in different positions, magnified.
- d. Genital aperture of female magnified.
- e. Natural length of male.

Fig. 2.—*Linyphia subnigripes*, Cambr.

- a. Full figure of spider, magnified.
- b. Forepart of caput showing the position of the eyes.
- c. Genital aperture, viewed rather obliquely.

Fig. 3.—*Synageles venator*, Luc.

- a. Female magnified.
- b. Male ditto.
- c. Profile of male, without legs or palpi.

Fig. 4.—a. Genital aperture of *Agroëca brunnea*, Bl.

- b. Ditto of *A. proxima*, Cambr.





Lycæna argiades. Pall.

a. a. male; b. b. female.

Plant. *Lotus major*.



Notes on *Lycæna Argiades* Pall.

A BUTTERFLY NEW TO BRITAIN.

By Rev. O. P. CAMBRIDGE, M.A., &c.

Pl. V.

READ JANUARY 20TH, 1886.



T will be in the remembrance of some of the Members of the Field Club that at the Club's meeting at Bloxworth, on the 19th of last August, I exhibited a specimen (taken, by one of my sons, on Bloxworth Heath the evening before) of a butterfly, which I stated to be in my opinion new to Britain. The specimen exhibited was a female, and a good deal worn, still its possession of tails to the hinder wings distinguished it at once from all other known British species of the group, excepting one, *Lycæna baetica*. This last, however, was a species familiar to me, as I had taken a long series of it in Egypt many years ago, and the butterfly in question was totally different from it. The day following the Club's meeting, August 20th, a party of four of us proceeded

to the spot where the new butterfly had been taken, and before we had worked for ten minutes another of my sons captured a very fair specimen of the male. Of course we thought then that others would follow, but neither on that day nor afterwards, though we worked hard for several days and caught and examined at least 500 of the common species of the group, did we see another. The second example, however, enabled me to determine it to be *Lycaena argiades*, Pallas, described and figured in Kirby's work on "European Butterflies and Moths," p. 53., pl. 14, fig. 11. It is most probable that we happened to meet with the latest examples of a small summer brood of this insect, and that by working for it earlier next year we may find it in greater abundance.

The occurrence in these days of multitudinous "butterfly-catchers" of a new diurnal Lepidopteron, especially in a locality where I have myself worked off and on as an entomologist for over forty years, is both interesting and instructive. It is most probable that it has always existed there, but that being so like a worn or dingy looking example of one or two common species it has been overlooked until the accident of my son's capture turned it up. I confess that it is a good many years now since I should myself have chased and captured a worn looking female "blue;" but boys, especially beginners, chase and catch if it be possible, everything they see, and therefore good captures by novices are by no means unfrequent, while older collectors often fail to get rare things. And then when a new or rare species is once revealed it is curious how often other specimens are met with. Oddly enough it has turned out since that on the 21st August a worn example of this butterfly was caught close to Bournemouth by another schoolboy, in whose collection it was shortly after found by his schoolfellow, another of my sons. Collectors who wish to get this butterfly will have to catch and examine all the common "blues" they see, otherwise they cannot be sure that it has not

been passed over. It is, when on the wing, exceedingly like a worn *Lycaena icarus*, or *L. aegon*, but when captured the little tails appended to the hinder wings cannot fail to be observed. From the description appended to these notes, it will be seen also that the form of the anterior wings differs from that of *L. icarus*, as well as the markings on the under side. From *L. aegon* it differs in not having the characteristic distinct black border always present on the wings of that species. A notice of the occurrence of this butterfly appeared in the "Entomologist" for October last (1885), and in the November number of that Journal the Rev. J. S. St. John writes from Whatley, near Frome, Somerset, that he finds two examples of it among some other Lepidoptera captured there 11 years ago, but that until the notice of our captures (accompanied by a wood-cut figure of the insect) they had not been identified as distinct from the common British species. It is very probable that it exists, thus overlooked, in other collections also, and would doubtless still continue to be overlooked, but for its occurrence and identification elsewhere being made known.

Lycaena argiades is well-known on the continent of Europe, being found (see Lang's "Butterflies of Europe," and Kirby's work above noticed) in Central and Southern Europe, as well as in North-Western Asia and South of Siberia and the Amur. Dr. Lang also adds that "it frequents meadows and is generally a common insect." There are two or three broods a year the individuals of the spring brood being smaller than those which appear later in the season. The larva feeds on trefoil and other Leguminosæ. Close to the spot on Bloxworth Heath, where the specimens now recorded were taken, the greater Bird's-foot trefoil, *Lotus major*, grows in abundance; very possibly this is its food in that locality. The plate accompanying this paper has been kindly drawn for me by my nephew, Frederick O. P. Cambridge, and represents the plant mentioned, as well as both sexes of the butterfly, showing the upper and under sides of the wings in

the two sexes. In the Jan. (1886) number of the "Entomologist," vol. xix., p. 5, is an elaborate paper on the above occurrence of this butterfly, by Mr. Richard South, who discusses it fully under these heads—i., is it indigenous; ii., or due to recent immigration; or, iii., to the conscious or unconscious agency of man? Mr. South admits the possibility of the latter, but believes the species to be a true native, probably coming into England during the middle of the Post Glacial epoch along with its congeners (abundant though local in the South of England), *L. Adonis* and *L. Corydon*.

DESCRIPTION OF *LYCÆNA ARGIADES*, PALL.

FROM THE BLOXWORTH EXAMPLES.

Male.—Width, $12\frac{2}{3}$ lines; upper wings much more rounded than those of *Lycaena Icarus* (the common blue), and rather more than those of *L. Ægon* (the silver-studded blue). Colour lilac-blue, lighter or darker according to the incidence of the light upon the wings, and narrowly-edged with black; the hinder wings have a small prominent point on the hind-margin near the inner corner, continued in a small, slender, but quite distinct black, white-fringed tail; outside the tail, near to and parallel with the margin of the wing, are two not very distinct black spots. The wings are somewhat transparent, and the nervures are distinctly marked by five dusky black lines. The fringes of the wings are pretty perfect, and appear to be a mixture of black and white. All the wings are dusky blackish towards the margins, not distinctly bordered like those of *L. Ægon*. The under side is whitish grey, silvery blue towards their insertion in the thorax; two distinct orange spots, edged above with black, occur about the middle of the hinder margin on the under side of the posterior wings. One of these (immediately above the tail) has a largish distinct black spot at its base; a few small black spots are scattered over the rest of the under side of the posterior wings, and a row of others, some of which are rather elongate,

runs parallel with the outer margin of the anterior wings, and between this row and the margin, and also parallel with it, are some indistinct dusky markings.

Female.—Width, 13 lines. Upper wings dusky blackish brown, sprinkled with some lilac scales towards their base ; lower wings similar, but with more of the lilac scales, which form a kind of broad and widening lilac band from the base to the outer margin ; a black spot occurs close to the "tail," with a round orange spot immediately above it. The tail is similar to that of the male.

It appears from Kirby's work that the male also usually has an orange spot visible on the upper side of the posterior wings near the tail ; and that those specimens wanting it (like the example above recorded) form the variety *Lycaena coretas*, Ochs.

Lycaena argiades should be looked for where the "blues" occur and where its food plants grow from the end of May till July, and again, for the second brood, from the middle of August to the end of September.





Coronella laevis, Boie.

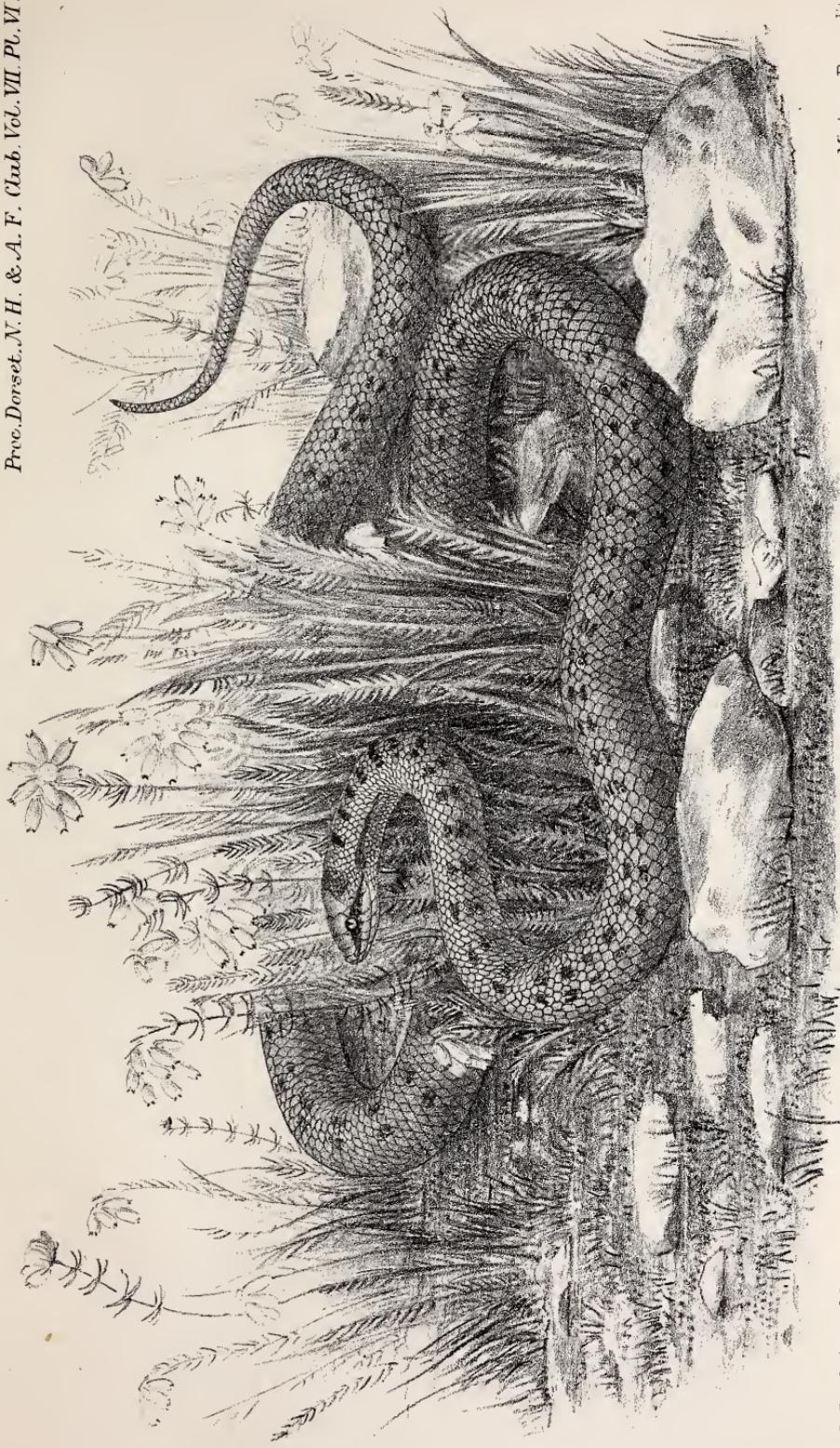
(SMOOTH SNAKE, OR LIZARD SNAKE.)

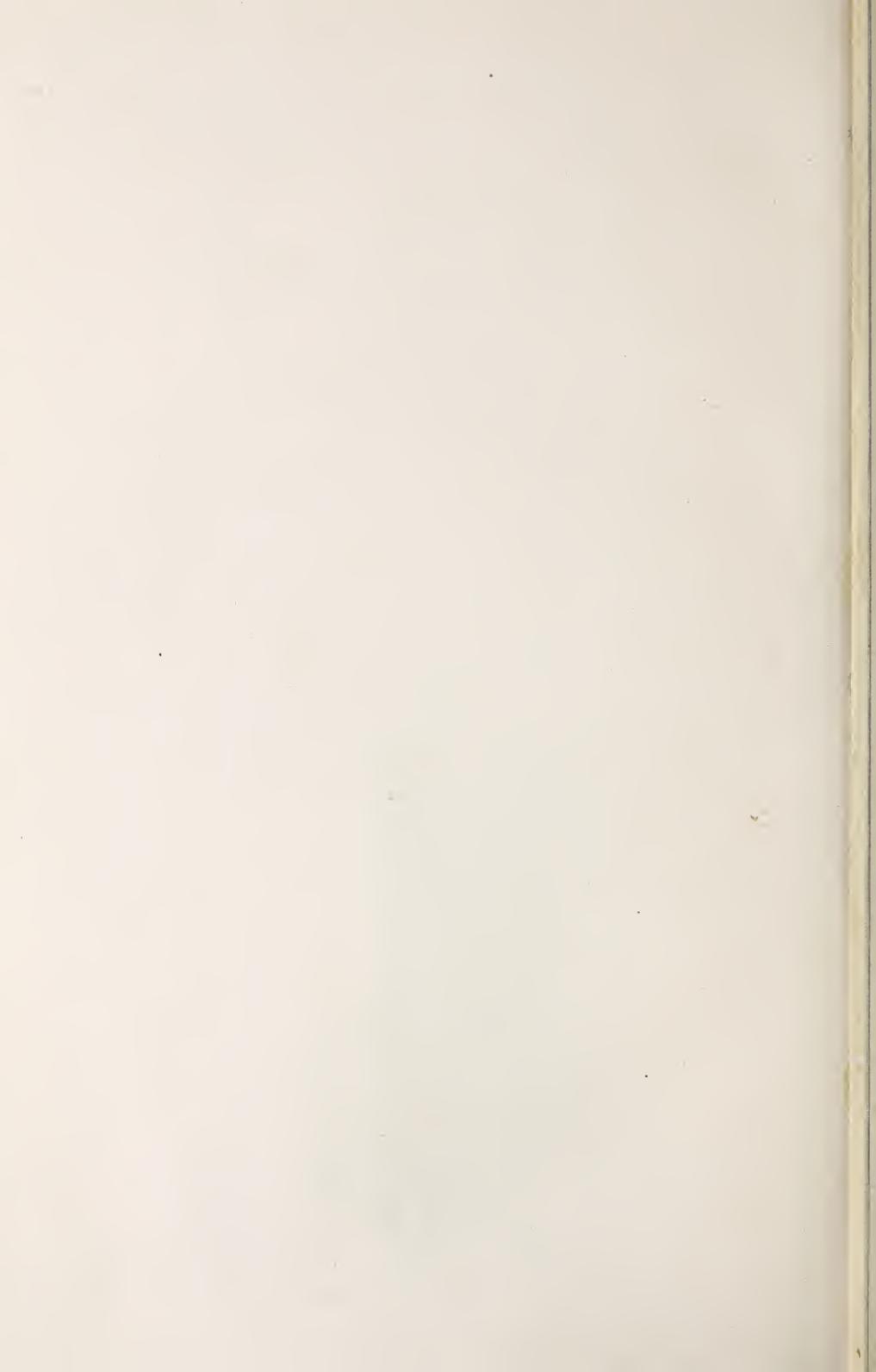
By Rev. O. P. CAMBRIDGE, M.A., &c.

Pl. VI.

Syn. *COLUBER AUSTRIACUS*, Buon. Lord Clermont "Reptiles and Quadrupeds of Europe," p. 224.

With many persons it is a matter for congratulation that the number of reptiles indigenous to Britain is small, and still more so that of this number few belong to the *Ophidia*, or serpent order. For my own part I confess to a natural antipathy to all reptiles. It is abhorrent to me to touch or handle them whether dead or alive, and yet the Natterjack toad croaking in its swampy lair, the heath lizard, and even the adder basking in the sun or gliding away at the approach of danger, all add a charm to the immediate surroundings, deeply felt though not perhaps capable of very definite expression. I have, however, had sufficient proof of the venom of the reptile last named (the adder), and have on several occasions been very nearly bitten by it, so that I am quite content with the dispensation (whether providential or otherwise) which has allotted to Great Britain only that *one* venomous species, and only *three* species altogether. On the Continent of Europe *twenty-four* species are





known, and of these *four* (including our adder) are venomous. Most people, I imagine, have been hitherto aware of only one other British serpent besides the adder, and that is the common or ringed snake (*Trepidonotus natrix*) Dum. and Bibr. I do not here reckon the slow-worm (*Anguis fragilis*), which is rather a legless lizard than a serpent. A figure and general description therefore with a few additional remarks on a now well-established third species of British serpent may not, perhaps, be uninteresting to our members; more especially as its British habitat at present appears to be confined to the sandy heath districts of Dorsetshire and the adjoining county of Hampshire.

The first undoubted capture of this snake, *Coronella laevis* or smooth snake, in Britain, was in June, 1853, by Mr. Frederick Bond, between Wimborne and Ringwood, on the borders of Parley Heath. I was present on that occasion, entomologising with Mr. Bond. We agreed that it was new to us, and, with little doubt, new also to Britain. Mr. Bond took the specimen with him to London, fully intending to get it examined and determined by the British Museum experts; but amid the many distractions of the height of the entomological season it was merely put into spirit and subsequently forgotten, until the record of a specimen received at the British Museum from Bournemouth (where it was found by the Hon. Arthur Russell, in 1859) appeared in the *Zoologist*, 1859, p. 6731. On reading this notice Mr. Bond immediately recognized the species we had met with six years before, and on sending his example to the museum its identity was at once established, *Zool.*, 1859, p. 5787. During numberless rambles on Bloxworth Heath from 1853 to 1872 I was on the look-out for this snake, but only once saw an example, which I failed to capture. It was not until June, 1872, that I succeeded in authenticating it in that locality by actual capture. (*Zool.*, 1872, p. 3113). Records, however, of its occurrence in the New Forest have been published, in 1862, by Mr. F. Buckland in the "Field" newspaper, where other

notices also, I believe, subsequently appeared, by the same writer, but without details of time and locality (See Zool., 1869 (2), p. 1658).* Since 1872 I have seen it much more frequently and captured it occasionally in order to have always by me one or two preserved specimens for friends who have wanted it either for their own, or for public collections. In the year 1879 it was unusually frequent on Bloxworth Heath. Several were killed in one day in September or early in October of that year by a shooting party, under the impression that they were adders. Having been informed of this on the same evening, by one of the shooters, at a dinner party, I took a moonlight tramp that same night over the heath to redeem two of their victims, feeling quite sure (as it so turned out), that they were *Coronella laevis* and not adders; the next day being Sunday, I feared too that before the Monday they would be made prize of by some old carrion crow or other vermin. One only, however, proved to be worth preserving, the other having been too much damaged in the anxiety of its slayer to ensure its destruction.

The following additional records of its occurrence may be found in the pages of *Zoologist*, between the year 1859 and the present time. *One captured alive* in Holme Lane near Wareham by Mr. Arthur Adams, and sent to the Zoological Gardens in the spring of 1863 (Zool. 1864, p. 8928); *three seen*, two of which were captured, near Bournemouth, in June, 1865, by Dr. Blackmore (Zool., 1865, p. 9734), and *three taken* near Bournemouth in 1871 by Mr. E. B. Kemp-Welch and another gentleman (Zool. 1872, (2) p. 3150). Not only therefore is its authenticity as a British species more than fully established, but its recent comparative frequency (in my own district at least) is undoubted. During the past summer (1885), I have seen it several times,

* Mr. A. D. Bartlett (of the Zoological Gardens, London) has a very interesting paper on this snake in the *Intellectual Observer* of April, 1863; his informant, Mr. Fenton, considered it to be a hybrid between the adder and the ringed snake.

capturing it twice. On each of these two occasions a slight tap near, but not on, the head appeared to paralyze it, as it seemed for some time quite dead, and was placed in a small canvass bag as dead, though on reaching home several hours afterwards it had quite recovered and was as lively as ever. The first of these two was put into a roomy cage with glazed sides, and perforated zinc cover, and a clod of heather to bask upon in the sun or to conceal itself under. Thus, attended to by one of my sons, and furnished with a small vessel of water and a few blue bottle-flies *per diem*, it lived from June till the beginning of September, always active, retaining its plump well-to-do appearance, and changing its skin once. It became also very tame and docile; if lying under its piece of turf, it would, on hearing my son whistle or call to it, come out at once and rear itself on its tail as if to enjoy a little conversation. One day, however, it managed, for the second time, to push aside with its nose a small ventilating slide at the side of the cage, and the door of the room being also open, it made its escape into the shrubbery and was found no more. The other example (captured at the beginning of August) also thrrove fairly well, but it did not show signs of becoming tame like the other. It was, finally, sent, on my son's going to school, about the middle of September, to the Zoological Gardens, Regent's Park, where I trust it is still alive and flourishing.

I will now venture to make a few remarks on this snake, and conclude with directing attention to the well-marked specific characters by which it may be at once distinguished from the common snake, and (more important still) from the adder, in mistake for which it is often slain by gamekeepers and others on our heaths.

I have noticed above that a very slight tap with a stick appeared to paralyze it, but that in the two cases there noted it soon recovered. This was not so, however, with the first example I ever obtained (Zool. 3114). In this case the snake

never stirred, nor recovered in any way, after a blow, apparently no stronger than those from which the others soon rallied. Mr. Kemp-Welch (Zool. 3150) also mentions the fatal effect of a slight blow. On the other hand three examples subsequently taken alive, and which I wished to preserve as specimens with as little injury as possible, seemed quite unaffected by piercing through the brain with a penknife. In these cases, chloroform had to be used freely afterwards before immersion in spirits of wine.

The next point I would notice is in respect to its reproduction. Schlegel (quoted in Zool. (2) 1,658) and afterwards confirmed in one instance by F. Buckland, "Field," 1862, tells us that it is *vivi-parous*; while according to another authority (Opel, Zool., 9511) it is *ovi-parous*. The truth probably is that being generally ovo-viviparous, like the adder, it at times produces its eggs before the extrusion of the young.

Then with regard to its *food*; that is probably for the most part the sand lizard (*Lacerta agilis*); this species is frequent in the same localities inhabited by the snake, though, as proved by Dr. Blackmore (Zool. 9735), it will freely devour our other lizard, *Zootoca vivipara*, which is also found in some of the situations affected by *Coronella lævis*. In confinement it devoured slow-worms as well as lizards (Zool. (2) 1659), but would not touch frogs ("Our Reptiles," M. C. Cooke, pp. 57 and 59).

Dr. Günther ("Field," 1862) states that in attacking a large lizard a smooth snake he had in confinement seized it by the tail, which the lizard at once threw off, and the snake proceeded to swallow. Dr. Günther further remarks that the snake always afterwards seized them by the tail, and refused to attack tail-less lizards. Very possibly this propensity of the snake may account for the frequent occurrence on our heaths of tail-less or stumpy-tailed lizards. M. C. Cooke (l. c. supra p. 57) says it will eat mice. Those which, as I have stated, we kept in confinement, and exhibited to the members of our Club last August,

refused to touch small frogs and toads, only occasionally devouring spiders, but blue-bottle flies whenever given ; finding that the snakes thrrove on this diet we did not try them with other kinds of food. Mice, slow-worms, and the viviparous lizard are comparatively scarce on our heaths, its food, therefore, with us is probably, for the most part, the *Sand lizard*.

A correspondent (Zool. 9559) states that *Coronella lævis* emits a strong odour for defence ; but Dr. Blackmore (Zool. 9735) says it emits no smell at all even when irritated. I myself have never noticed any odour in either of the examples I have obtained, so I conclude that if it does emit an odour it is of rare occurrence. Opel (Zool. 9511) states that its colour after sloughing is a beautiful steel blue for six or seven days. Each of the two we had in confinement changed its skin, but the only difference I noticed was that they were of a somewhat brighter and clearer hue than before. In one of the examples the spots and markings were scarcely visible until after the change of skin. This snake is of a bold and fearless nature ; one of those I captured (having come upon it suddenly) reared itself erect on its tail to its full height, hissing and darting out its forked tongue in a very pugnacious way. It certainly seems to me to be much more frequent on our heaths than it was when I first discovered it there ; and I often hear of its being seen by others. Its usual habitat is, no doubt, dry sandy spots, but I have on several occasions met with it in marshy ground among rushes and swamp herbage. With regard to its mention in general works on British reptiles, it is thought by some authorities to be identical with a very young obscure example described and figured many years ago by Sowerby* as a new species—*Coluber Dumfriesiensis*—found near Dumfries and noticed by Dr. Bell ("British Reptiles," 1849, p. 60). Dr. Bell, however, did not consider it to be a good species ; and on the whole its claim to be identical with *Coronella lævis* appears very uncertain. M.

* Brit. Miscell., p. 3, t. iii., and Loud. Mag. Nat. Hist. II., p. 431.

C. Cooke "Our Reptiles," 1865, gives a long account of it, with a description and figure, and subsequently Edward Newman (who calls it the lizard-snake) (Zool. (2) p. 1653, 1865), in "Collected Observations on British Reptiles," reviews and criticises all that was then known about the species from continental and other authorities. There is a full description of it also in Lord Clermont's work on "Quadrupeds and Reptiles of Europe."

Its range is stated to be in Central and Southern Europe inhabiting various parts of France, Sicily, Italy, Galicia, Siberia, Switzerland, and Belgium (where it is said to be rare), also so far north as Upsala in Sweden, being common round, Gothenburg.

DESCRIPTION OF *CORONELLA LÆVIS*.

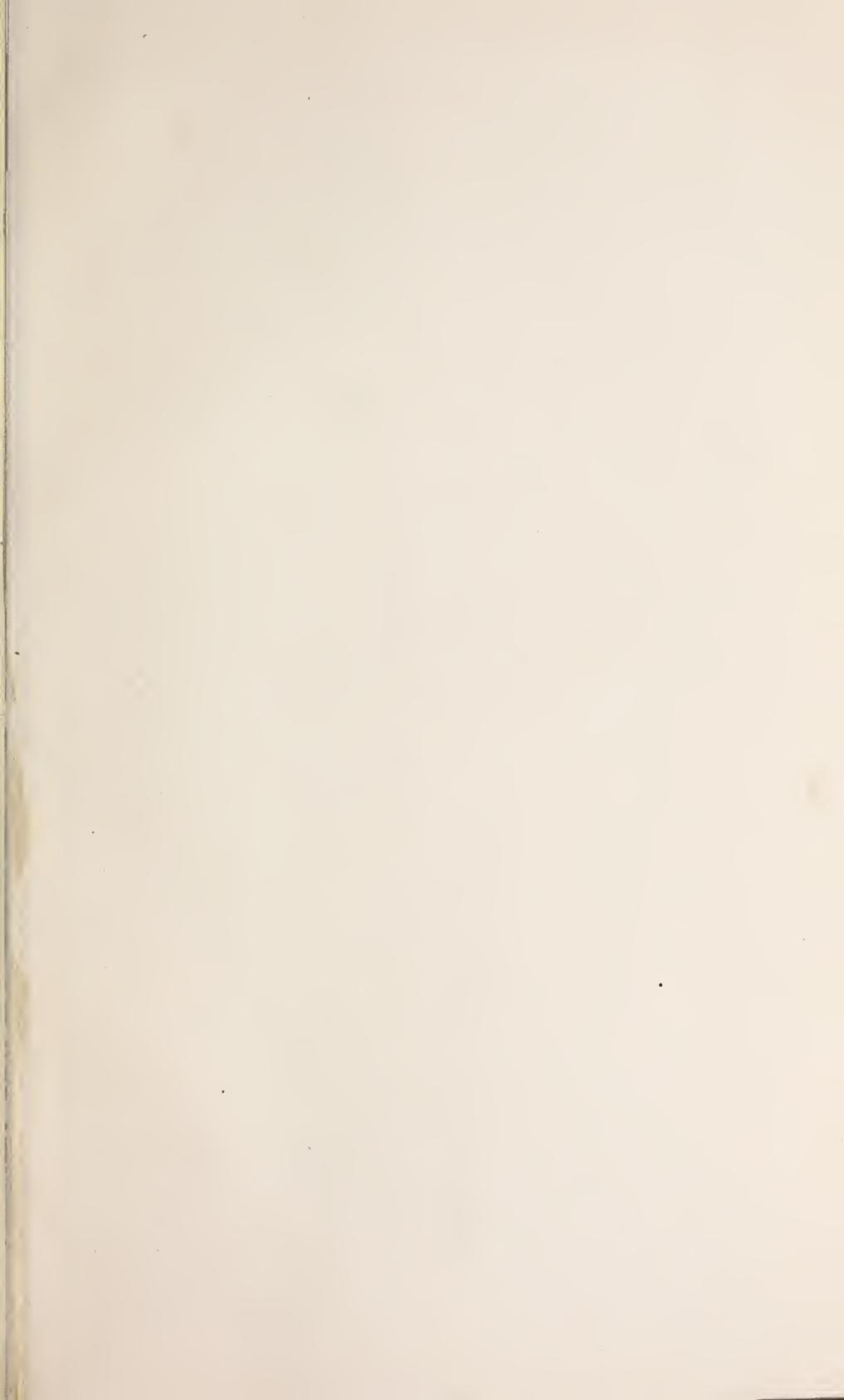
Smaller than the common or ringed snake; more nearly resembling the adder both in size and general appearance. It is, however, quite harmless. Its length, when full grown, varies from 18 to 25 inches. This last measurement is that of the largest specimen I have ever met with, a female, and is that from which the accompanying figure was drawn. The head is not much broader than the neck, and the tail is rather short. The general hue, above, is a greenish brown tinged with grey, or sometimes with a dirty-yellowish colour; along the back are two parallel rows of blackish spots or irregular markings, and a single row of more or less distinct somewhat similar markings runs along each side. When the dorsal markings are large, strongly developed, and almost confluent, its resemblance to an adder is very close. The under side is paler than the upper, and often marked or marbled with black. The head has two large black patches, almost confluent, at the occiput; a strong black dash runs close below each eye horizontally backwards, and after a slight interruption continues a little way along the side of the neck. Excepting where the dorsal spots are large

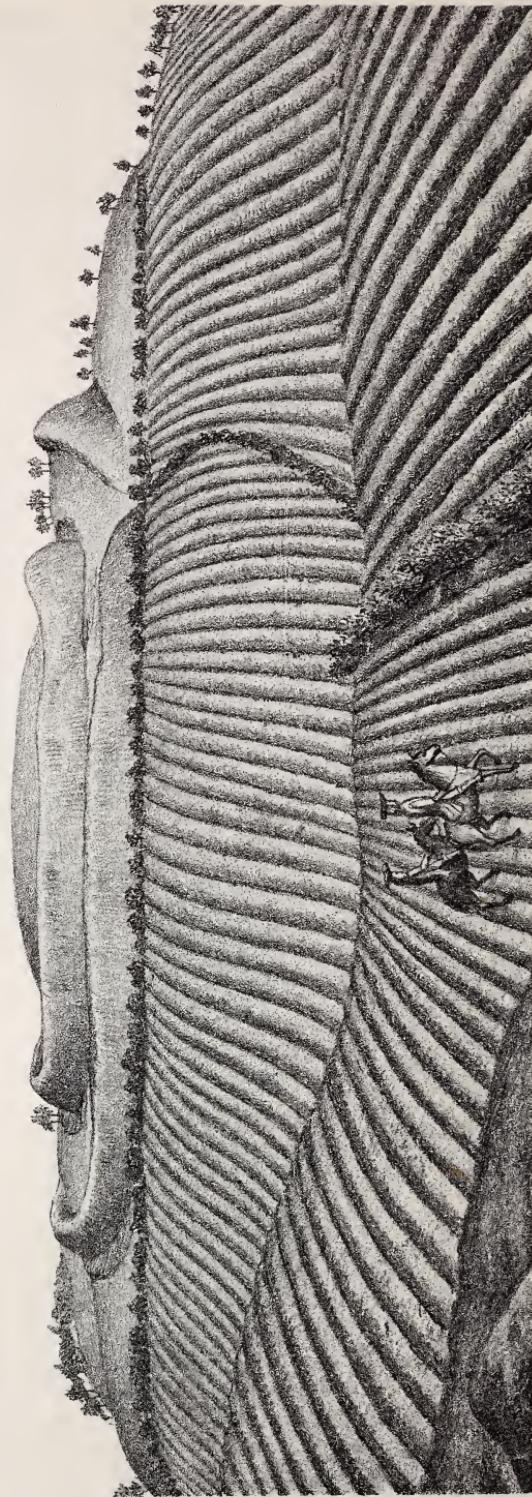
and confluent (which is not often the case) this snake may be easily known from the adder by the absence of the continuous, longitudinal, zigzag, dark dorsal stripe so characteristic of that species, and which commonly looks like a chain of coalescing diamond-shaped markings. The head also of the adder is broader. Large examples of the common snake cannot, of course, be mistaken for the smooth snake; but from smaller or immature specimens of its more abundant congener it may be distinguished in a moment by the absence of the clear, bright, pale (sometimes yellow), curved, transverse marking on each side close behind the head of the common snake; these pale markings almost meet at the occiput and form a kind of ring round the back of the head—whence its trivial name, “ringed snake.” The scales in *Coronella laevis* are also smooth, not carinated as in the common snake, from which it also differs in its systematic position, being of a different tribe and genus. As this is not intended to be a strictly scientific description I had not purposed noticing in detail the generic and other more minute characters of this snake. The following, however (from Lord Clermont’s work), will, perhaps, make my remarks more complete:—“The rostral plate presses much upon the muzzle, is of a triangular form, with its top pointed; there are seven labial plates on the upper lip, on each side, of which the third and fourth touch upon the eye; scales of the body smooth; rhomboid, in nineteen longitudinal rows; ventral plates 160 to 164; subcaudal 60 to 64 pairs; one anal plate divided. The upper maxillary teeth are on the same line with the others, and longer.”

[On the reading of this paper at the Dorchester meeting, January 20th, 1886, Mr. William Penney, of Poole, read some notes on *Coronella laevis* drawn up from his own and others’ observations. Various instances besides those above noticed were given by Mr. Penney of the occurrence of this snake both in Dorsetshire and Hampshire, and the fact was noticed of an instance of the

emission of a fluid with a smell like that of the common snake. Mr. Penney also noted the occurrence near Poole of two specimens of a black variety of this male, one of which he exhibited in spirits of wine.]







WOODBURY HILL, SOUTHERN VIEW.
(From an old engraving. — Sudley, delt. E. Kirkall sculpt. 1724.)

Printed Bros. lith.



Woodbury Hill.

By Rev. O. P. CAMBRIDGE, M.A., &c.

Read on Woodbury Hill, August 19th, 1885.

Pl. VII.



AM sorry that the explanation of this ancient spot has not fallen into better hands than mine.

I fear that the most I can do is to recapitulate in a short form what I have gathered, so far as its antiquity goes, from "Warne's Ancient Dorset," which I presume contains all that is certainly known of this undoubtedly British Camp.

The area is said to be 10 or 12 acres in extent, which I conclude is that of this flat top, not including to the base of the fosse. The form of the Hill is an obtuse angled triangle, which gives, as in most British works, its form to the camp. The chief (and probably the only original) entrance in ancient times, is at the north-east. It is surrounded by a double rampart, including a fosse, but not of great strength. In some parts

where the Hill is very steep, it is simply scarped, and there is there only one rampart.

Portions only of these fortifications now exist, the sides of the hill having been much levelled by cultivation, and near where the sheep fair is annually held a great part of the second rampart was only a few years ago carted away bodily, for the sake of the gravel it contained. This act of vandalism was stopped, though almost too late, by the efforts of the late vicar, Rev. F. Warre.

It has been considered by Coker and Hutchings that Woodbury Hill was a Roman station—the “*Ibernium*” of the Itineraries, which it is generally agreed was situated between *Vindogladia* and *Durnovaria*. But no Roman remains have been found on it, and it is said not to be on the line of the *Via Iceniana*.

Mr. Warne, however, concludes by stating that he had found many Roman remains widely dispersed over *Kingston Down*, which is only a mile or two distant, and through which this *Via* passed, and as Woodbury Hill is also exactly half-way between *Vindogladia* and *Durnovaria*, he thinks that this is probably the true site of *Ibernium*.*

The fine view from this hill needs but little explanation; on the south we see *Flowers Barrow*, *Bindon Hill*, and *Gallows Hill*; on the east, *Woolbarrow* (*Oldbury* or *Wold-barrow*) *Corfe Castle*, *Branksea Island*, 9-barrow down, near *Swanage*, *Creech-barrow*, and the whole range, in fact, of the Purbeck Hills. To the north-east are *Badbury Rings*, and a view extending to beyond *Salisbury*. In the far east, on a clear day, are distinctly visible the white cliffs of *Scratchells Bay* and *Freshwater* in the Isle of *Wight*. To the N.W. we look over *Whatcombe* to *Bulbarrow*, and so on northwards to the *Giant's Head*, while to the west *The Castle Rings*, or *Weatherbury Castle*, near *Milbourne*, with its modern Obelisk invites attention.

* From this, however, the President and others dissented.

The Annual Fair* held here, under the authority of a Charter granted in the reign of Henry III., 1216, is probably known either by repute or experience to all present. It was formerly a several days' business (from the 18th to the 23rd of September), each day being allotted to some one special branch of the traffic carried on here. † It was in fact a great annual market for every sort of commodity, and all the households for many miles round laid in here their annual stocks of

* *Hutchins* (Hist. Dor.) says that the Fair began "on September 18th, the Nativity of St. Mary!" but that festival occurs on the 8th!! The 18th was undoubtedly the first day of the fair, but how it is connected with the Festival of St. Mary's Nativity is not clear. The first day of the Fair now is the 21st, St. Matthew's day, which is supposed by some of the inhabitants of Bere to have been formerly connected with Roman Catholic festivities in honour of the Blessed Virgin Mary, and to have also had something to do, in that connection, with the drinking of the waters from the Anchorets well. Perhaps the Anchorets Well may have been dedicated to St. Mary the Virgin, and a fête and pilgrimage instituted to the Well on the Nativity of the Virgin Mary, September 8th, or in old style September 20th (not 21st, as my informant supposed). This would seem the more probable as the 20th—All-folks' day—was the day when the most people would be at the Fair; or, indeed, that day being already the Nativity of the Virgin Mary and the Pilgrimage Day, may have made that the day for All-folks to flock to the Fair, whence it would therefore have obtained its name. I may mention here that a tradition as to the origin of the Fair was handed down to me by an old lady, many years since deceased, of the family of Manuel. This family lived in Bloxworth until recently, during several hundred years past, and held also considerable property in Bere. The tradition was that a pedlar, travelling with a pack of cloth at his back, was overtaken in a great storm, and thoroughly soaked, pack and all, with the rain. Passing over the Hill as the storm ceased and the sun shone out, he unpacked and spread the cloth out to dry; the country people living near, struck with the goodness of the cloth, then and there made such advantageous offers for it, that in a few hours the whole was disposed of, to the satisfaction of all parties. The tradition continues that at about the same time in the following year the Pedlar again passed that way, and this time unpacked his goods purposely to invite purchasers, and with such success that he was induced to repeat it in following years: other traders also joined with goods of other descriptions, until at length the business was still more enlarged and a Charter obtained, as above noted, in the reign of Henry III., A.D. 1216. 1232, 1236 [1216 = Henry's Accession]

‡ The number of days was five.

1 (On September 18th) Wholesale day.

2 (19th) Gentlefolks day.

3 (20th) All folks' day.

4 (21st) Sheep-fair day, on which cattle and other live stock were also sold.

5 (22nd) Pack and Penny Day.

various goods. One day was especially allotted to the pleasures and entertainments for the upper classes, and called "*Gentle-folks day.*" Another day was *Sheep-fair day*. Another *All-folks day*, another, on which the Fair opened, was called *Wholesale day*, ending at last with *Pack and Penny day*, or the day before the hill was deserted, and when everything could be purchased very cheaply, rather than that the sellers should be troubled to carry their goods away, a long journey to the next fair, held at Shroton beyond Blandford. On the *Gentle-folks day*, in bygone years, many of the élite of the County assembled and took part in the pleasures and entertainments of the Hill. Among these used to be reckoned the shaking of the Country-lads of the neighbourhood into their new leathern breeches by an ancestor of Mr. Rolls, breeches-maker, of Puddletown. Roast pork used to be a special viand, provided here for the first time in the season, at an old house of entertainment of which now only the site remains. The *Oyster season*, too, was inaugurated here, doubtless the supply coming from the Poole Beds. Large masses of oyster shells are (I believe) even now to be found near the entrance at the north-east side of the hill. I have myself—now as far back as 50 years ago—and indeed since—seen as many as from 20 to 40 gentlemen's carriages and turnouts of one kind or another on the hill on the *Gentle-folks day*. At the present time the whole business and pleasures of the fair are comprised in two days, of which the first lumps together the Sheep fair and all the other days but one, *i.e.*, *Pack-and-Penny day*. I hardly think the world at large would be much the worse, and I am sure the immediate neighbourhood would be much the better, if the whole Fair were suppressed, as its business has gone almost to nothing; though I am bound to say that the *pleasures* of the Fair are less mixed with iniquities and abominations since the Rural Police replaced the old Parish and other Constables. Its plea for existence as a gala day for

the rustics has almost disappeared, since numerous cheap excursion trains now offer more rational outings to more distant points of interest.

A tradition exists of a deep well, called the "Anchorets Well," on the hill, in which is supposed to be a valuable treasure in some such form as a golden *table* or *tablet*. To this well, it is said, people used to flock on the 21st of September, to drink of the water, many virtues* being attributed to it. Money offerings were made on the occasion, and were paid over to the Abbots of Tarrant. A deep well of never-failing water still exists on the Hill, but it is not now used, and is, by some, thought not to be the ancient Anchorets Well. Also somewhere, on the western side of the Hill, it is said, are the foundations of a church, dedicated to "Saint Anchoretta," and which was in reality the mother church of that of St. John the Baptist, Bere Regis.

It may perhaps interest some of you to know that Woodbury Hill and its Fair have been utilized by one of our members—Mr. Thomas Hardy—for the localizing of some of the scenes of his interesting and able Novel, "Far from the Madding Crowd."

PLATE VII. gives us, without a doubt, a correct view of Woodbury Hill, from the south or south-west, in 1724. I am indebted to Mr. T. B. Groves, of Weymouth, for the loan of an old print of 1724, picked up by himself in a print shop in London, and from which this plate has been lithographed. Since it was in the lithographer's hands I have ascertained that this print is that drawn by Stukeley and engraved by E. Kirkall, to illustrate the short notice of Woodbury Hill in "Stukeley's Itenerary" of 1724. Hutchins subsequently utilized this plate, in a modified form, for his History of Dorset. It seemed to me

* I am told at Bere Regis that Woodbury Hill formerly went also by the name of *Woodbury St. Mary*! Can this have any connection with another piece of information I have lately received, that, in France, Roman Catholics still pray to *our Lady Mary of Woodbury*?

worth adding as an illustration to my notes on the Hill, as showing what a very regular and perfect camp it must have been only a century-and-a-half ago. It is scarcely possible to realize it now in its present defaced state, disfigured also as it is by numerous dwellings of the most unsightly imaginable kind and aspect. The greater part of the ploughed field in the foreground is now covered with a dense wood and oak timber trees.





Bloxworth Church.

By Rev. O. P. CAMBRIDGE, M.A., &c. (Rector.)

Read at Bloxworth, August 19th, 1885.



LOXWORTH CHURCH appears to have been originally a small Norman structure, of which the doorway, with its nail-head ornament, is the only remaining portion. The church was rebuilt probably in the 14th century, partly in *pointed*, partly in the *decorated* style. Subsequently, some time in the seventeenth century, another restoration, or rebuilding (excepting the tower), took place, resulting in the present substantial though debased Gothic of the Nave and Manor House Aisle. At this rebuilding the Chancel appears to have been restored (in part) out of the materials of the body of the church. Portions of the 14th century restoration are curiously mixed in and utilized in the 17th century rebuilding, a window sill, for instance, being inserted as a square head for a two-light pointed window, in which all the original cusps are chiselled off the mullions.

The Chancel was rebuilt by the present Rector in 1870, the windows being either the old ones restored or copies of them.

The church contains several objects of interest, among them being the Hour Glass and Stand (figured and described in our Club's Proceedings, vol. iii., p. 34). Its date is probably about the middle of the 17th century—or Jacobean. Another object worth examining is the mural monument in the Manor Pew to Sir John Trenchard, this is considered to be a fine specimen of mural monumental sculpture. The bells also are of interest. The Tenor bell is missing, having been removed by (I am sorry to say) an ancestor of my own, who was at the time Squire and Churchwarden, about the year 1780, under a plea that it was cracked, and might be utilised in repairing the church. The repairs, however, not having been executed within a reasonable time, some little grumbling took place at a subsequent vestry, when it was found that the bell had been sold and the proceeds invested in a large, new brewing copper which is still in the brewhouse at the Mansion; in the result the whole sum expended in repairs of the church from this unwarrantable sale of Church property amounted to about 16s. The largest of the two remaining bells is, in a technical sense, "ancient," *i.e.*, it dates at least from the 14th century. It is encircled near its lower rim by a number of antique letters, each divided from the next by a cross. This puzzled an experienced campanologist (Rev. T. Archer Turner) who examined and made a cast of it several years ago. Mr. Turner inclined at first to think that this circlet of letters was unmeaning, and what is called by Campanologists a "Bell-founder's jumble," but the Rev. J. F. Langford (who is with us and has been our kind and able conductor at Bere to-day) suggested, what was afterwards confirmed by the recently-deceased eminent Campanologist, the Rev. John Ellacombe, that these disjointed letters formed the words "Sancta Maria," to whom probably the bell was dedicated.

In addition to the Norman doorway I would call attention to a curious label-moulding round the tower window, the rudely carved heads at the ends of which face each other, in what I believe to be, a unique position.

The Font is plain, round, and massive, with a strong Norman look, but being ornamented on one side with a large fleur-de-lys carved in relief, it is probably Jacobean, possibly dating from the same time as the 17th century rebuilding of the church.

The Nave has a waggon roof, ornamented at the intersections of the ribs, with painted wooden shields of the Royal Arms, in the various forms and quarterings of the Jacobean period.

The Manor House aisle contains numerous quarterings of the Arms (painted on the walls), of the Savage Family, who were then Lords of the manor, and by whom Bloxworth House was built at the beginning of the 17th century.

A curious epitaph is visible, in some lights, on the tomb, outside the church, of a former Rector, the Rev. Mr. Welsted:—

Here lies that Reverend Orthodox Divine
Grave Mr. Welsted aged seventy-nine.
He was the painfull Pastor of this place
Fifty-five years compleate, during which space
None justly could his conversation wound,
Nor's doctrine taint, 'twas so sincere, so sound.
Thus having his long threed of life well spunne,
Twas cutt November's tenth in fifty-one.

1651.

I will conclude these few remarks by observing that “Cardinal Morton,” from whose family our President is descended, was, some time in the 15th century, Rector of Bloxworth, and obtained the appellation of the “ Fighting Parson of Blokesworth.”





Pilsdon.

By the Rev. W. BARNES.

Read on Pilsdon Hill, September 9th, 1885.



DO not think that there is any mystery in the name of Pilsdon; as, I suppose it is simply Pillesdun, or the dun or down of Pille, the name of some old owner, as that of Lambert's Castle.

The earth-works, such as Pilsden, were formed before the back-reach of any history; and, as I believe, by the free tribes, or clans of Britons each under its tribe head (pencenedl) long ere the time of any head King of Britain, such as Cassibellaunus, or of Moelmud (Moelmeed) who lived three or four hundred years before the Nativity; and I do not think that any Briton could have told the Romans, either from history or tradition, by what clan Pilsden was cast up.

The earth-works of Dorset are of four kinds, those for defence, those for protection of cattle, those for meetings of civil business, as for law, or religion, and those for burial, as barrows and cromlechs.

The earth-works for defence or protection were cast up against four evils. 1st, for safety of men and cattle against another tribe in full force, or in bands in war. 2nd, to save their cattle against cattle-theives at night. 3rd, against wolves at night; wolves being then very rife in Britain. 4th, against the straying of cattle in the night over the then far less fenced grass land.

Now I would name as cattle-garths, Buzbury near Blandford; and even that great rambling, and not very strong earth-work on Eggerdon Hill, besides others.

In the summer half-year at least, the cattle would often be grazing on the far-reaching downs, and herdsmen would be keeping watch and ward over them by day and night; and the herdsmen at night would drive their herds into their cattle-garth, where they, the herdsmen, would have huts.

The people, indeed, did not always live in the hill fortresses or cattle garth, but down at the homestead (trev).

In the laws of Hywyll Dda (in the tenth century) the home-stead is called the Hen-drev (hanedrev, or old home), and the herdsmen's hut on the mountains, the hâvdy (havdee), The summerhouse and (hâvod) summer abode, is still the Welsh for a dairy-house. Of course, if herdsmen had their cattle near a war camp, they would make use of it as one of the best of cattle garths,

On Eggerton Hill there are some few hollows, such as are called hut-holes, though I think they would be better called hearth-holes, as I have met with some people who took them as marking the size of the hut, as if each Briton lived in a kind of case, like a "Jack in the Box," or Diogenes in his cask put up on end; but two clerical friends, Mr. Sylvester and Mr. Ken

dall, have kindly given me descriptions of bodies of British huts built of stone, and now standing. One near Penzance, and a cluster of others on Dartmoor. The one near Penzance is only 16 feet in diameter, but one of those on Dartmoor is 40 feet broad, and 11 of these huts, as measured by Mr. Kendall, range from 19 feet to the 40 feet one.

A worthy member of our Club some time ago, cleared out some of the hollows on Eggerdon, and found them to be basins pitched with stones ; and though it does not follow that all huts had hollow hearths, yet such ones would have been very good for the keeping of the fire brands together.

We may like to know when the Britains began to make hay and keep it in ricks for cattle in winter. The British word for a scythe, “ *pladur*,” is not a Latin one, and was not taken from the Romans.

The Romans took many of the British strongholds and formed *castra*, within, or of them, as Cirencester (Caer, Coryn), Hod Hill, which I hold to be the Roman *Ibernium*, of which the British form, I suppose, was Caer Iwern.

However, it will be found that the Romans chose the strongholds that were by water, and were shy of the dry ones. Chichester, in Hampshire, “ *Caer Cei*,” has a stream running more than half-way round it, and it is still called by its British name, the Llevant. It may be that the cattle in a dry cattle-garth could do without water through the night, and would find it abroad in streams or water holds by day. It too often happens that when your Club meet on an earthwork such as Pilsden, they see only the banks and greensward by which they can learn little more from one *caer* than from another. It is to be wished that, with leave of the landowner and some money to spare, a share at least of the green coverlet could be lifted, so that the members and friends of the Club might have a chance of seeing some interesting tokens of the works of man.

Even a trench dug for some length might show something

worth finding. If you will excuse a poor joke, I would say, spades should come before Clubs, such as yours.

The description of Pilsdon in Mr. Warne's master book on the Antiquities of Dorset should be read by those who have it. As to the parallelogram on the area of the earthwork, the geometrical truth of the outline seems to me to imply a hard or smooth flooring within it. I wonder what is under its turf ?





The Manor of Pillesdon.

By THOMAS BOND.

Read on Pilsdon Hill, September 9th, 1885.



THE Manor of Pillesdon at the Domesday survey was not a very large one. It consisted of only three sides, which belonged to Edric, one of the King's thanes, who also held lands in Tyneham Stocke and Ilitlye. It afterwards was the property of a family who assumed their name from the place, one of whom, Eudo de Pillesdon, was living in 15 Henry II. Ten of the family were crusaders. Warresius de Pillesdon was living in the time of Richard I., and died on his journey to Jerusalem. Jordan de Pyvelsdon, or Pyllesdon, in 25 Henry III. had letters of protection from the Crown on going into the Holy Land.

From the Pillesdons this manor passed hereditarily in the time of Edward III. to the family of le Jew by the marriage of Alice, daughter and heiress of Sir John de Pillesdon, with John le Jew. Elizabeth, daughter and heiress of Sir John le Jew, of Whitfield, in Somer-

setshire, brought it to her husband, Sir John Hady, of Stowet, in Somersetshire, a manor which he purchased in the 5th year of King Henry VI. He was of an ancient family in Devonshire, which seems to have derived its name from some place called Hode, in that county, where Jordan de Hode sold a knight's fee in the time of Henry III. or Edward I.

Sir John Hody was a successful lawyer as early as in 3rd Henry VI., in whose reign he was returned to Parliament as representative of the borough of Shaftesbury, and in 1334 and 1340 he was elected a knight of the shire for Somerset. In the latter year he became Lord Chief Justice of England, but his tenure of that high office was of short duration, for he died before the 25th January, 1442. Lord Coke in his preface to Littleton's *Institute* classes him amongst the "famous and expert sages of the law." A copy of his will is amongst the archiepiscopal archives at Lambeth, by which he disposed not only of his lands, but *inter alia* of a considerable quantity of silver vessels and silver gilt cups, showing that the table of a Lord Chief Justice in the 15th century was richly furnished.

Sir Alexander Hody, elder brother of Sir John, was a juror of consideration, and was elected four times to represent the county of Somerset in Parliament. Taking part with the House of Lancaster he was attainted after the battle of Wakefield and all his lands were forfeited. They were afterwards, however, restored to his nephew, son and heir of the Chief Justice.

An uncle of Sir John Hody, bearing the same Christian name, was Chancellor of Wells and Archdeacon of Dorset, and in later times the family produced another eminent Divine in Dr. Humphry Hody, who was the author of several publications.

From the Hodys the manor of Pillesdon passed to the Wyndhams of Trent, county Somerset. Sir Hugh Wyndham's house here was searched by the Parliament's soldiers under the idea that King Charles II. was concealed in some part of it.

Lady Montfort, daughter and heir of Sir Frances Wyndham, sold Pillesdon to Sir Theodore Janssen, whose 4th son, William Janssen, left it to his daughter, Williamsa, the wife of the Honorable Lionel Damer, 5th son of the Earl of Dorchester. After the death of the latter it was sold to the Rev. Gregory Raymond in 1828, and from him it passed to his niece, Elizabeth, wife of the Rev. H. J. Bewes, of Fontmell Parva, in this county.





On a Tufaceous Deposit at Blashenwell, Isle of Purbeck.

By J. C. MANSEL-PLEYDELL, Esq., F.L.S., F.G.S.



THE Post-tertiary or Quaternary beds include a variety of superficial and cavern deposits of two distinct periods, the oldest containing mammalian remains of recent and living species, the other of living species only, many of which have migrated to other latitudes, namely the reindeer, the elk, the glutton, the brown bear, the chamois, the ibex, &c. The mollusca of both divisions do not differ from those now inhabiting Europe. The older deposits include marine debris, brick earths, cavern-breccia, and appear to have been laid down in the vicinity of ice-fields and glaciers under extremely cold climatal conditions. Rain generated from an extremely humid atmosphere, and the drainage of glaciers, after following the water courses and carrying with them all obstacles which oppose a free passage, on meeting a fissure or cavity in a calcareous rock occasioned by a fault or the corrosive action of underground sources forcing their way through the flanks of an escarpment have often left an adit for the entrance of the men and wild beasts whose remains these subterranean chambers so often and abundantly

contain. There are proofs of a succession of periods of repose occasioned by the recession of the stream, when layers of mud or stones were deposited, varying with the force and power of the current. These alluvial deposits are intercalated with layers of bones, flints, and other evidences of man's occupation, and are occasionally covered by a layer of stalagnite formed by the droppings of water from the roof. Cotemporaneous with the older cave deposits are the terraces of gravel and loam high above the present level of our rivers, and marking their ancient beds; like the caverns these terrace-gravels contain both extinct and living species. At that period every group of mountains had their own snowfields and glaciers, and sent down their morains far over the plains below. The similarity of the mountain flora to that of high latitudes at sea-level, leaves no doubt that at one time there was an uninterrupted uniformity of climate in Europe, and an arctic flora covered its entire area.

When southern Europe was covered with an ice-sheet as far south as the valley of the Thames, and even to a lower latitude in Germany, its flora was restricted to the arctic willow, the dwarf birch, mosses and lichens, while many animals migrated southward; for instance, we find the reindeer in Switzerland, the musk sheep and arctic fox as far south as the Pyrenees, and the mammoth in Spain and Italy. This state of things was succeeded by a genial change; the ice-sheet retrograded northwards, and finally vanished from the lowlands; its final dissolution in Great Britain was accompanied by a wide spread of drifts, gravel, sands, and a sprinkling of erratics. It is supposed that little or no ice floated about during their deposition, and that these mild and glacial epochs succeeded each other more than once. We find the region visited by the reindeer and the arctic fox, the lion, striped and spotted hyena, elephant and hippopotamus.

We now arrive at the second division, characterized by the presence of animals belonging to living species, and when

Palæolithic man had long since disappeared. The last glimpse we have of him is in Southern France, with the reindeer and other arctic animals. We find his successor in central Europe after the northern flora and fauna had re-instated themselves in their original homes. He introduced the progenitors of our domestic animals, and was the constructor of the long-barrows; he is supposed by some ethnologists to be represented by the Basques of north-western Spain, by the French of Aquitania, by the Welshmen of Denbighshire, and by the inhabitants of the south-west of Ireland.

The ice-age with occasional interruptions of warmer periods was succeeded by the period to which belong raised beaches, river-alluvia, low level-terraces, and tufaceous deposits. Every spring of water contains mineral matter in solution, obtained from the rocks through which they pass. Rainwater charged with ammonia, nitric and sulphuric acid, carbon, besides nitrogen, oxygen, and organic substances, will precipitate some of the materials it holds in solution on its passage through a lake, and if lime is present, which will be the case if the beds through which it has passed before issuing from the spring happened to be calcareous, a tufaceous bed will be formed. The process of deposition will necessarily be slow, and the purity of the bed will depend upon the proportionate purity of the stream.

I consider the Blashenwell bed belongs to this division. Its upper margin lies at a level slightly below the juncture of the Purbeck limestone with the Hastings sands, where an intermittent spring now sends forth a feeble stream, conveyed to the river by a ditch; in all probability it flowed into a small lake depositing on its passage some of the lime with which it was charged, derived from the calcareous rocks above. The bed of the lake became filled up in course of time and is now covered with herbage.

The tufa contains a large assemblage of land, freshwater, and two species of marine-shells. The presence of land shells migh,

be accounted for by the action of floods and wash from the neighbouring heights, many of them belong to species which secrete themselves in dry pastures under stones, such as *Helix lapicida*, *H. pulchella*, *Cyclostoma elegans*, and others which inhabit meadows and moist situations, as *Helix sericea*, *Succinea oblonga*; other land spoils accompany these molluscs such as fragments of bones, teeth of mammals and flint implements; none of these are bulky, nor of greater gravity than an ordinary land-wash is capable of conveying. The presence of the limpet and periwinkle—two marine shells—is difficult to account for. By what agency could have they been introduced?—certainly not by natural means, as the sea could not have reached the heights of Blashenwell during the deposition of the bed; neither by the agency of sea-fowl or cliff-birds, as they are never found on lands adjoining cliffs, much more at the distance of a mile. Both species—the periwinkle, *Littorina littorea*, and limpet, *Patella athletica*—are usually associated with kitchen middens or refuse heaps of prehistoric man. They are occasionally found in tumuli. The probability of man's agency is strengthened by the presence of bones purposely fractured in order to extract the marrow they contain; a fragment of the jaw of a red-deer, *Cervus elephas*, fragments of burnt wood and a few artificially worked chalk-flints, their sharp edges and medial ridge attest to some kind of manipulation and lead to the supposition that there was a human occupation in the neighbourhood of this ancient piece of water.

The nearest flint-bed is the chalk-range which extends from Swanage to Lulworth, and is more than a mile distant, with the Corfe valley intervening. Among the gravels which here and there overlie the oolitic beds on the south there is not a fragment of a flint to be found.

In conclusion, although the age of the bed cannot be conclusively arrived at, the presence of fractured bones, the jaw of the red deer, the two edible sea molluscs, and the flint

implements gives a certain amount of circumstantial evidence of a civilization usually attending savage life.

LAND SHELLS.

<i>Helix Cantiana,</i>	<i>Helix rotundata,</i>
<i>ericetorum,</i>	<i>Achatina acicula,</i>
<i>hispida,</i>	<i>Cyclostoma elegans.</i>
<i>lapicida,</i>	<i>Zonites Celarius,</i>
<i>nemoralis,</i>	<i>Cochlicopa lubrica,</i>
<i>pulchella,</i>	

FRESHWATER SHELLS.

<i>Bythinia tentaculata,</i>	<i>Succinea oblonga,</i>
<i>Limnæa peregra,</i>	<i>Valvata cristata,</i>
<i>truncatula,</i>	<i>piscinalis.</i>

MARINE SHELLS.

<i>Littorina littorea,</i>	<i>Patella athletica,</i>
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MAMMALIA.

<i>Cervus elephas,</i>	<i>Equus, sp.</i>
<i>Bos, sp.</i>	<i>Ovis, sp.</i>

FLINTS.

Fragments brought from a distance, apparently worked, having cutting edges and a medial ridge.

With the exception of *Helix Cantiana* the molluscs of this deposit are common to the district. Ten of them *Valvata piscinalis*, *Limnæus peregra*, *L. truncatulus*, *Succinea oblonga*, *Bythinia tentaculata*, *Helix hispida*, *H. pulchella*, *Cyclostoma elegans*, *Cochlicopa lubrica* and *Littorina littorea*, date as far back as the coralline and mammaliferous crags of England. *Limnæa*, *Bythinia Valvata*, *Helix*, *Cyclostoma*, and *Achatina* occur in the oligocene strata of the Isle of Wight. *Zonites* in the pleistocene. *Patella* dates as far back as the middle of the Palæozoic period.



